# THE MONTHLY

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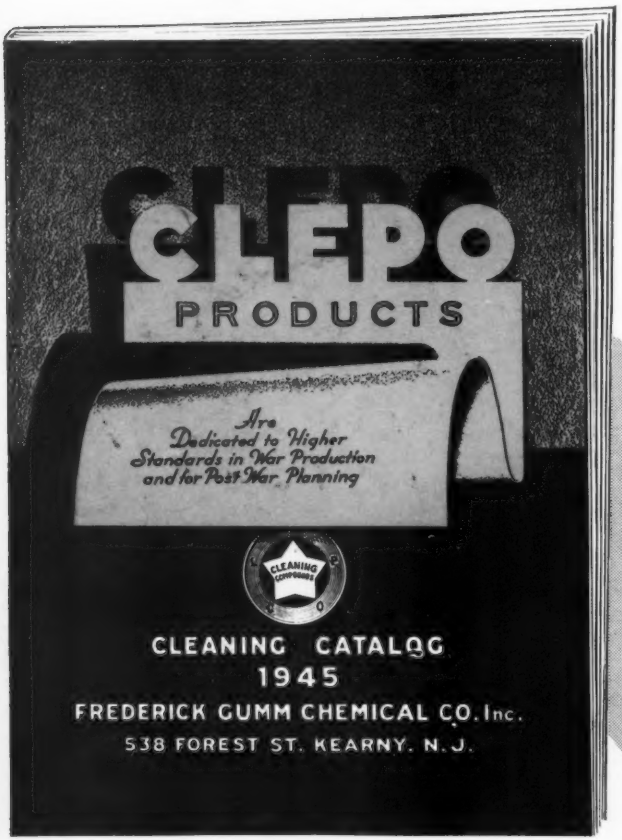


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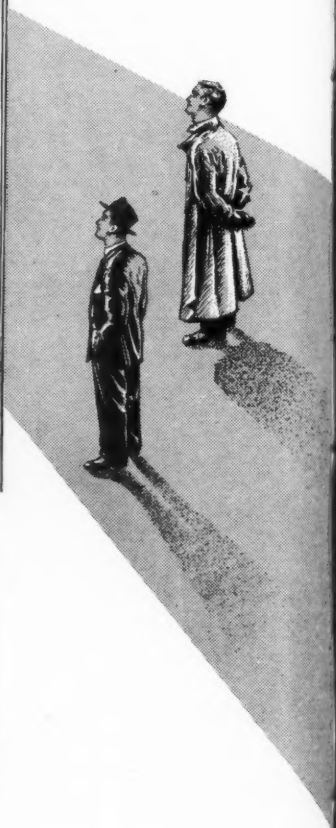

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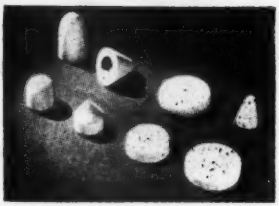

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# HIGH SPEED NICKEL PLATING

BY W. L. PINNER

AND R. B. KINNAMAN

THERE is, available in the literature, ample evidence of the important role played by the chloride ion in nickel plating baths. Notable among developments are the following:

1. The report by Haring[1] of a marked increase in cathode efficiency at low current density, as a result of the addition of chloride.
2. Wesley and Carey[2] reported a permissable increase in cathode current density with a large increase in chloride content.
3. Pinner and Borchert[3] recorded that increased amounts of chloride ion resulted in a marked improvement in the smoothness of the cathode deposit.
4. Graham[4] found a lower concentration of chloride ion in the cathode film than would normally be expected. He associated this with burning. Logically, then, an increase of chloride in the body of the bath, resulting in its increase in the cathode film, should reduce burning.

The foregoing disclosures led to an investigation by the authors resulting in the development of a high speed dull, and a high speed bright nickel plating process permitting the commercial use of high current densities in decorative nickel plating not heretofore attained or, at least, not reported.

Wesley and Carey[2] had disclosed the use of a bath containing only nickel chloride and boric acid, operable at high current densities, and had anticipated the possibility of this development when they stated, "It may well be that further study of electrolytes containing both sulfate and chloride would disclose an intermediate composition which would be less corrosive than the chloride bath and productive of more ductile deposits, yet would retain to a large extent the advantages of the sulfate-free electrolyte."

The investigation here reported involved first an evaluation of the Wesley and Carey process to determine its utility as a commercial method for decorative plating. The claims made were found justified with one notable exception, and this, for an important part of the bath operating range. Particular reference is made to pH control in the extremely low range. Deposits obtained in these ranges, for example pH $1.5 \pm .3$, were considered most useable for decorative plating. Using such a bath condition, the pH change was found to be quite rapid so that the control of such a system warranted investigation and correction, if possible.

Normal purification procedures for the all-chloride bath were found to be difficult, as a pH higher than 5.0 was reached only with difficulty on treating the bath with nickel carbonate and a lime treatment was hardly more effective.

This article reports two baths, each having the same basic composition, each justifying the claims of Wesley and Carey, and extending them to include:

1. Good pH control.
2. Ease of purification.
3. Improved ductility of the deposit.
4. High current density operation.
5. Compatibility with certain available organic brighteners.

All other considerations previously cited were realized, specifically as listed by Wesley and Carey:

1. Lower tank voltage for a given current.

2. Ease of buffing.
3. Heavy, smoother deposits possible.
4. Substantial freedom from pitting.
5. Increased cathode efficiency.
6. Lower heating of solution by electrolysis at a given current.

For a bath containing only nickel chloride and boric acid, four different types of deposit can be obtained. These types are secured as a result of variation in solution concentration, pH, temperature and current density, all of which are interdependent to a considerable degree. These deposits were observed by Wesley and Carey who designated them as "semi-bright," "light matte," "dark matte," and "cracked." Their published work concerned itself with pH and current density at two different bath temperatures and using one bath composition.

It was undertaken, in the work reported here, to investigate pH and temperature effects in seven different bath concentrations at a given current density. Later, an optimum condition was chosen and permissible current densities were determined.

Early in the investigation, it was developed that our interest centered in the "semi-bright" deposit as being best suited for decorative plating and subsequent operations. Figure 1 presents, graphically, the pH-temperature-bath composition relationships which determine conditions under which, at 100 amperes per square foot, a semi-bright deposit is obtained.

The bath compositions involved in Figure 1 contained 40 grams per liter of boric acid, in addition to the amount of nickel chloride shown. The areas enclosed denote the ranges in which semi-bright deposits were obtained with the temperatures-pH relationships designated.

It will be noted that the semi-bright plating range is greatly extended as bath concentration is decreased. The range shown for the 300 gram per liter bath checks Wesley's findings. Note that the range of semi-bright deposits for a bath containing 400 grams per liter of nickel chloride is almost non-existent, whereas the range for a bath containing 200 or 150 grams per liter is quite extensive. The bath containing 150 grams per liter of nickel chloride exhibits the widest practical range. In the ranges shown for each bath, semi-bright, pit-free, burn-free deposits were obtained.

It is desirable to discuss the 150 gram per liter bath in somewhat more detail, inasmuch as this approximate concentration of chloride was eventually used in combination with nickel sulfate for the final objective. A pH of, for example, 1.3 is shown to be out of the semi-bright range for all temperatures recorded. At this pH and in terms of decreasing temperature, the deposit was dark matte, becoming light matte, and finally light matte with "crazed" cracks in it.

The all chloride baths, as briefly stated before, were found to have two marked disadvantages when used for semi-bright plating, namely difficult control of pH in operation, and difficult pH elevation for purification purposes. While it is true that the pH could be controlled by constantly adding muriatic acid to the solution in operation, it must nevertheless be recognized that such procedure would result in a constantly increasing metal content. Such a change would result in altered processing characteristics and could only be counteracted by uneconomical removal of part of the solution for nickel recovery or outright discard.

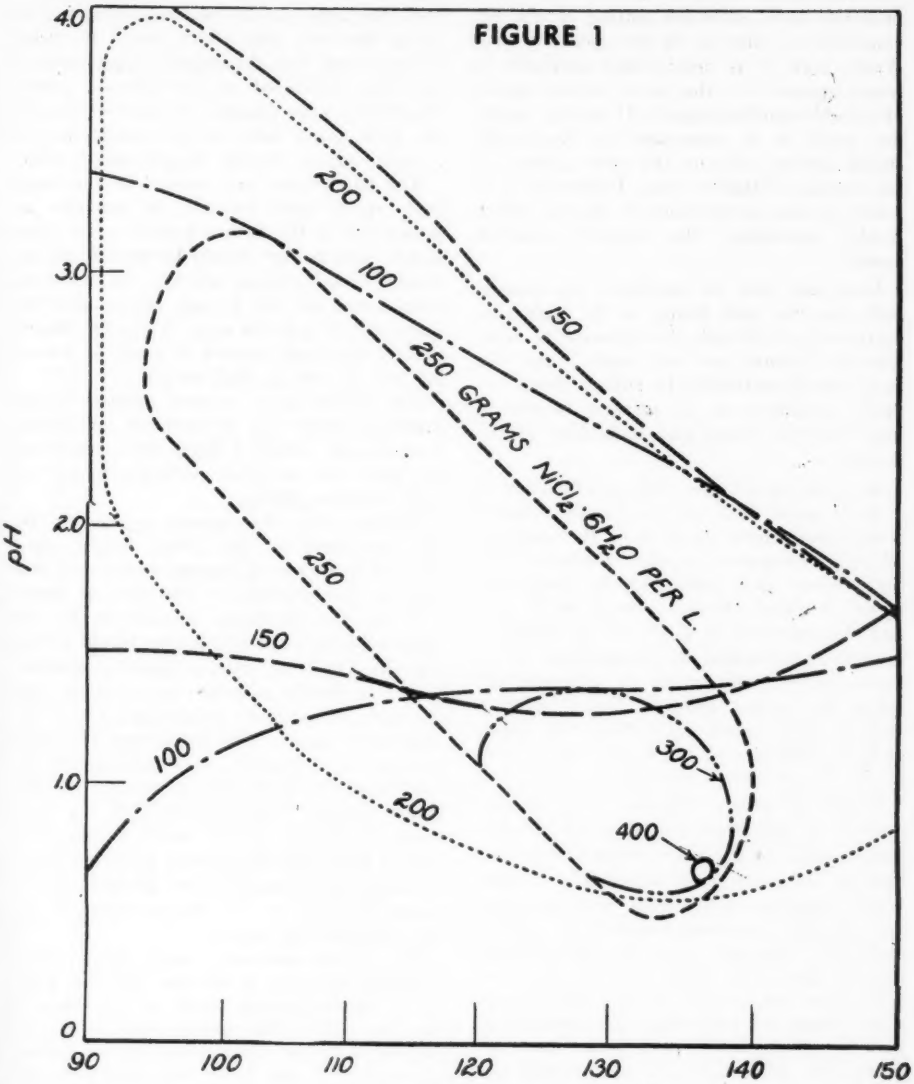
An important development evolved in the discovery that the addition of nickel sulfate in sizeable amounts did not materially alter the characteristics imparted by a high concentration of nickel chloride, but did obviate the two principle difficulties listed above. As might have been expected, the addition of sulfate improved the ductility of the nickel deposit over that obtained from an all chloride bath.

The bath composition finally selected contained:

| | |
|---|---|
| Nickel sulfate | 200 grams per liter |
| Nickel chloride | 175 grams per liter |
| Boric acid | 40 grams per liter |

In accordance with the data from which Figure 1 was constructed, optimum conditions of operation were selected involving a bath temperature at 115° F., at a pH of 1.5. The pH selected was in the low range so as to favor greater clarity of solution.

In the above bath, at the conditions stated, average current densities of 100 amperes per square foot were readily useable resulting in the deposition of .001" of nickel in eleven minutes. Actual current densities on certain sections of the work reached at least 200 amperes per square foot as unburned areas measured in excess of .002" in thickness, plated, as mentioned, in eleven minutes. Deposits obtained were quite smooth, in fact, they possessed buffing characteristics sim-




RANGES FOR DUCTILE, SEMI-BRIGHT DEPOSITS AT 100 AMPS. PER SQ. FT. WITH VARYING $NiCl_2 \cdot 6H_2O$ CONTENT.

ilar to an ordinary Watts solution plate, produced at 40 amperes per square foot.

In operation, the pH tends to rise at a moderate rate. Although pitting is not encountered as often as in the operation of a Watts' bath, it is nevertheless desirable to insure against it by the use of wetting agents or suitable oxidizing agents. If wetting agents are used, it is important to electrically shield heating coils or any other piping, as for example, filtration pipes. Failure to do so results in copious evolution of chlorine which would decompose the organic addition agents.

Lead may not be employed for heating coils, nor for tank lining as the high concentration of chloride is corrosive to lead. Karbate heaters are well suited and the tank should preferably be rubber lined. Cathode oscillation is of marked benefit in improving the luster and buffability of the deposit.

At a pH of 1.5, the cathode efficiency of a high speed bath of the finally selected composition above given is of the order of 98% as compared to approximately 85% for a Watts' bath containing the same total nickel, a nickel chloride content of 30 g./l. and also operated at a pH of 1.5. Figure 2 presents, graphically, the comparison of cathode current efficiencies at different pH values for a low chloride Watts' solution and the high speed bath. Measured values of 82% efficiency at pH 0.7, rising to 98% at pH 1.3 are indeed interesting.

Based on rather extensive experimental testing, no difference was noted in the protective value of the plate secured from this bath as compared with one from a normal Watts' solution. Qualitative tests revealed that the plate was considerably more ductile than that obtained from the all chloride bath. It should be borne in mind that this comparison relates only to the all chloride plate classed as semi-bright. The high speed plate is not as ductile as a Watts' plate although the difference is of no practical significance as qualitatively measured by bending pieces and noting crack formation.

Our attention was next turned to the possibility of incorporating the high speed properties of the bath with available brightening agents. Practically all of the proprietary organic brighteners were tried. Our search cannot be qualified as being exhaustive although it did include a rather full program of varying pH, temperature, and brightener content. The entire field was not covered by any means so that the type of organic material which we found compatible with the bath should not be considered as being the only one which could be used. It was found that the organic brighteners of the type disclosed in the Brown patent #2,191,813 were capable of incorporation in the high speed bath for the production of a high current density bright nickel plate.

The brighteners are present in the basic high speed bath formula in amounts as prescribed in the Brown patent, or in other words, just as they would be used in an ordinary nickel plating solution. An optimum temperature of 140° F. was chosen and the optimum pH is in the range 3.5 to 4.0. Bright plating has been secured at a pH as low as 2.0 and at least as high as 4.5.

The bright plate secured appears to be somewhat more free of incipient nodules in a reasonably clarified bath, thus exhibiting the effect of smoother cathodes typical of high chloride plating.

Mechanically, the deposit appears to be the equivalent of any other bright plate secured by means of organic addition of this general classification. Its hardness, as measured by the Bierbaum scratch method is comparable to other well known bright nickel deposits. On bend tests, it appears, qualitatively, as ductile as other bright plates. On the basis of hardness measurements and the qualitative observations mentioned, the high chloride concentration does not appear to detrimentally affect the properties of the bright deposit. It is possible that any lowering of ductility which might be expected from a high chloride content is insignificant as compared to ductility loss inherent in deposits obtained by the incorporation of organic brightening agents.

Due to the particular status of the electroplating industry at the time that the high speed bright plating bath was developed, (in late 1940) the process was used for plating nickel in thicknesses not exceeding about .0004", this being the maximum allowed on Houdaille-Hershey products by the Government. Such thicknesses were deposited over a buffed copper, or a bright copper, base. It is proper, therefore, to point out that the process is untried in heavier thicknesses except on an experimental basis. There is no evidence, however, that the production of heavy deposits will offer any more of a problem than is presented in lower speed bright plating processes. Indeed, indi-

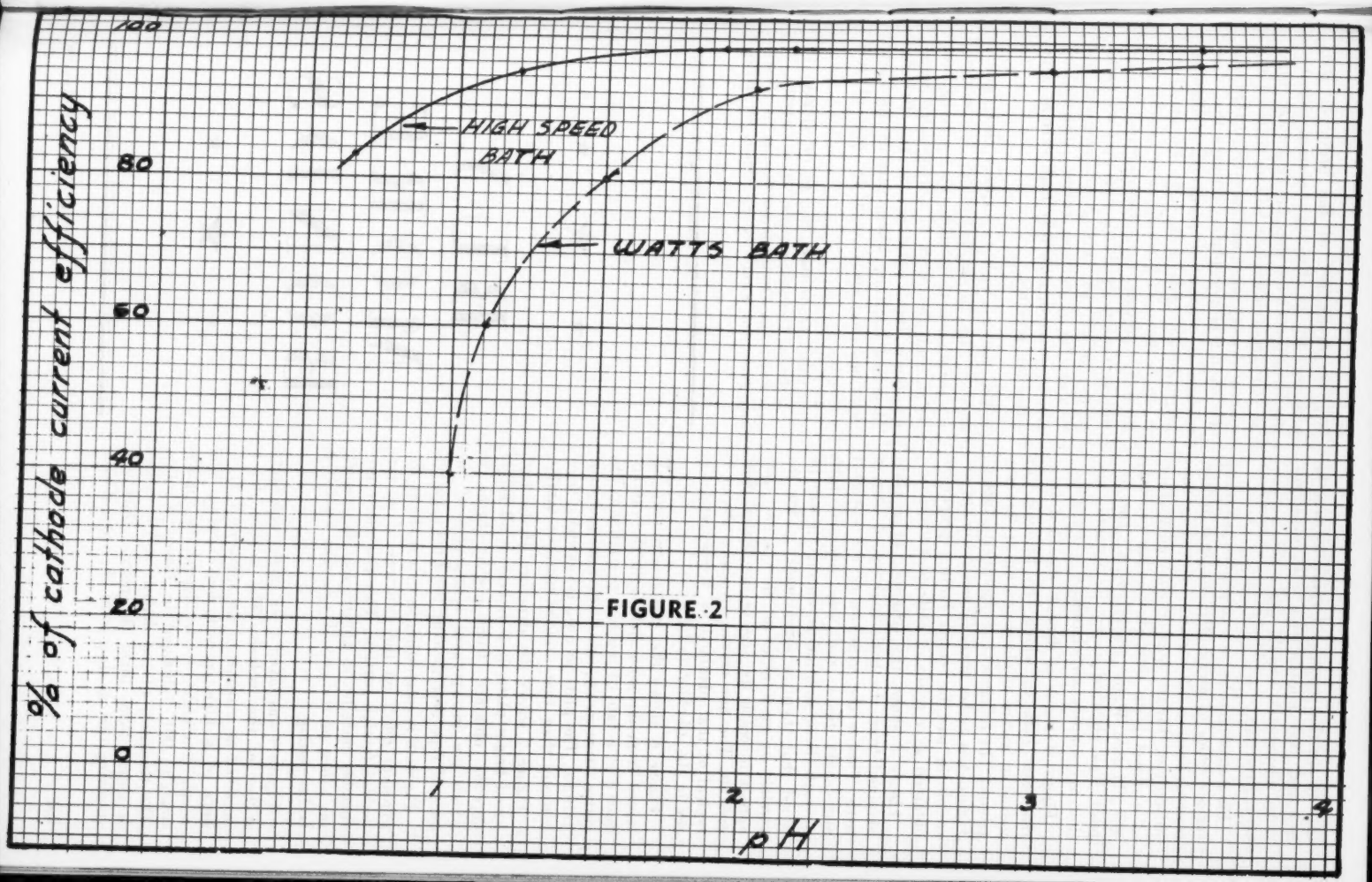

% of cathode current efficiency
100
80
60
40
20
0
HIGH SPEED BATH
WATTS BATH
1
2
3
4
pH

FIGURE 2

cations are that nodular formations may be less and this consideration with other obvious advantages, should make this process very attractive.

Photomicrographs are appended showing various types of nickel deposits, and are included because of certain interesting considerations. Figure 3 is a photomicrograph of a nickel plate secured from an ordinary low chloride Watts' plating bath. This deposit was obtained using no cathode motion nor solution circulation.

Figure 4 shows a deposit obtained from the same bath in which the cathode was moved at a rate of about ten linear feet per minute. The refinement of crystal structure in Figure 4 is rather marked and no doubt accounts in part for easier buffing properties obtained as a result of cathode motion.

Figure 5 shows the structure of a plate obtained from the basic high speed plating bath. This is the structure of the so-called semi-bright plate, and was obtained with no cathode or solution movement. It will be noted that there is some tendency for the crystals to grow although they at no time appear to reach the size of the Watts' plate crystals. The fine crystal structure shown is typical of that obtained by Wesley and Carey in the all-chloride bath.

Figure 6 shows the crystal structure obtained from the same bath with the cathode moved at a rate of ten feet per minute. The entire structure appears to be finer and more uniform. The plate secured is somewhat more lustrous than that secured without motion.

Figure 7 shows the structure of the high speed bright plate. It is typical of all bright deposits obtained from plating baths in which are incorporated brighteners of the general type described by the Brown patent.

Figure 8 is interesting in that it shows the apparent effect on the structure of an embedded foreign particle. This particle is presumably metallic in nature, and the radiating effect of the crystal structure around it is interesting.

Figure 9 was taken at an unguarded sharp corner of the cathode. The nodule shown occurred as a result of the deliberate allowance of a high current density area. The normal thickness of the deposit is approximately .001" obtained in eleven minutes. The thickness of the deposit at the corner is almost three times the normal thickness, involving that at that point the current density is presumably of the order of 300 amp./sq. ft. At this high current density, the structure of the deposits is normal, with no burning. It therefore follows that if high current density areas can be avoided through the use of proper plating fixtures that this process is capable of producing a useable bright nickel plate at at least 300 amp./sq. ft. In commercial practice, it is usually difficult to provide that the current density will be uniformly distributed over all parts of the article, but this photomicrograph indicates that if uniform current distribution can be secured, that very high current densities are possible.

The writers wish to express their gratitude to the Houdaille-Hershey Corporation for permission to publish the foregoing material, and also wish to acknowledge some assistance from personnel at the Battelle Memorial Institute, where part of the work described was performed by one of the authors.

1. Trans. Electrochem. Soc. 46, 107 (1924).
2. Trans. Electrochem. Soc. 75, 209 (1939).
3. Proc. Am. Electroplaters' Soc. p. 84 (1938).
4. Proc. Am. Electroplaters' Soc. p. 95 (1939).

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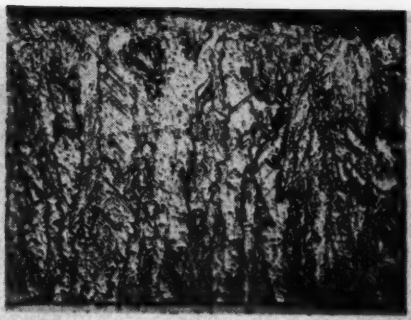
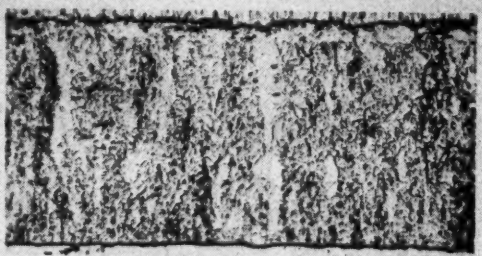


FIGURE 3



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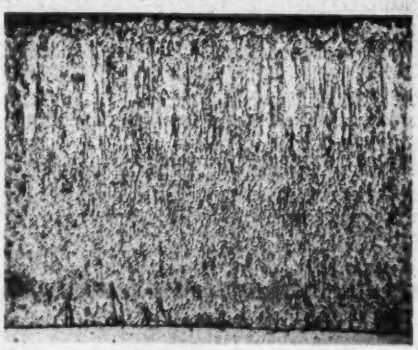

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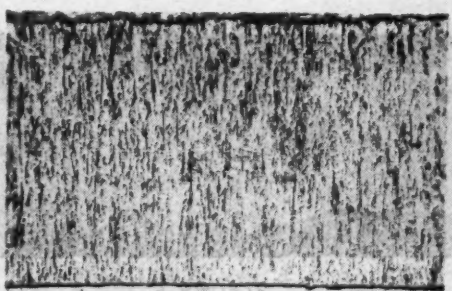


FIGURE 6

FIGURE 9

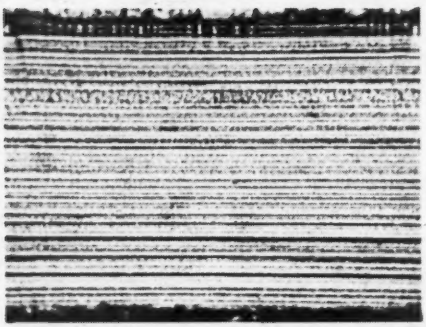


FIGURE 7

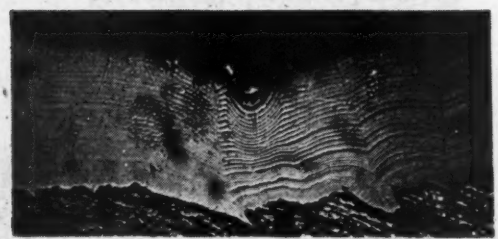
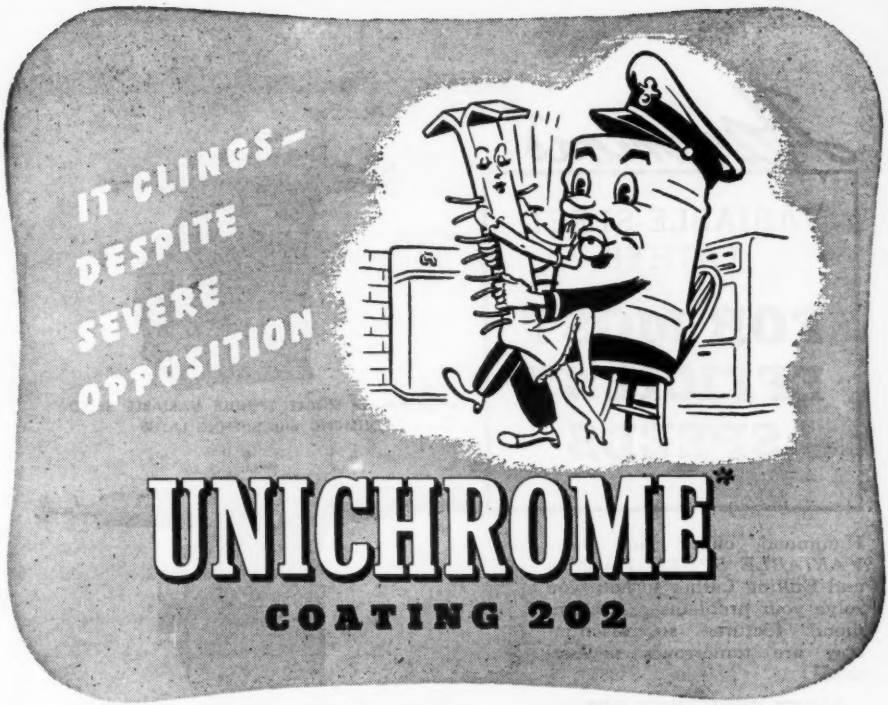


FIGURE 8

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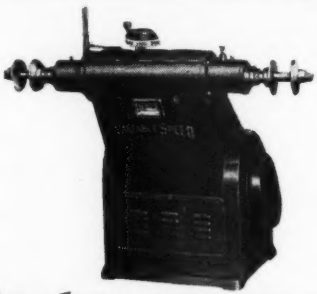

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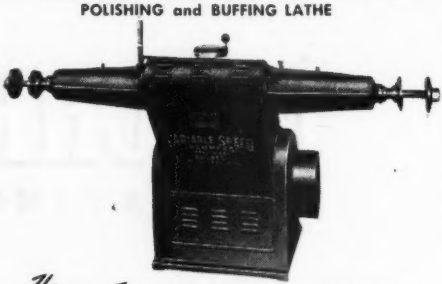

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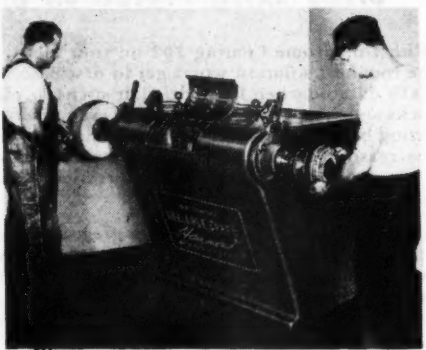

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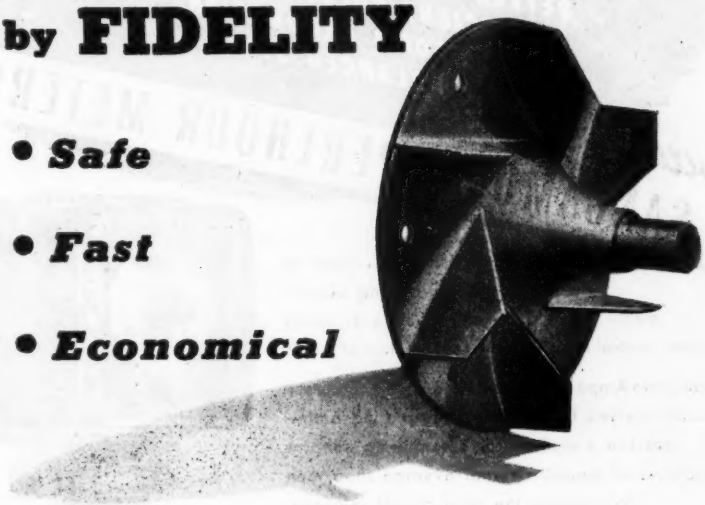

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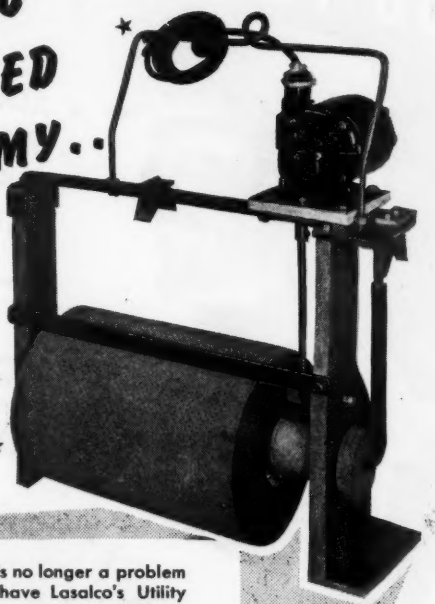

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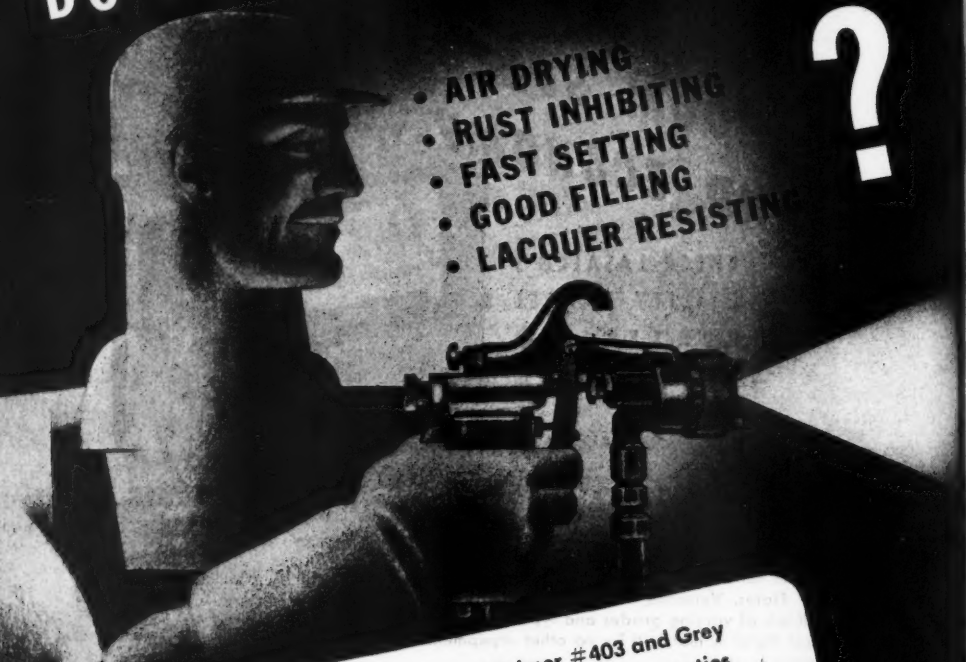

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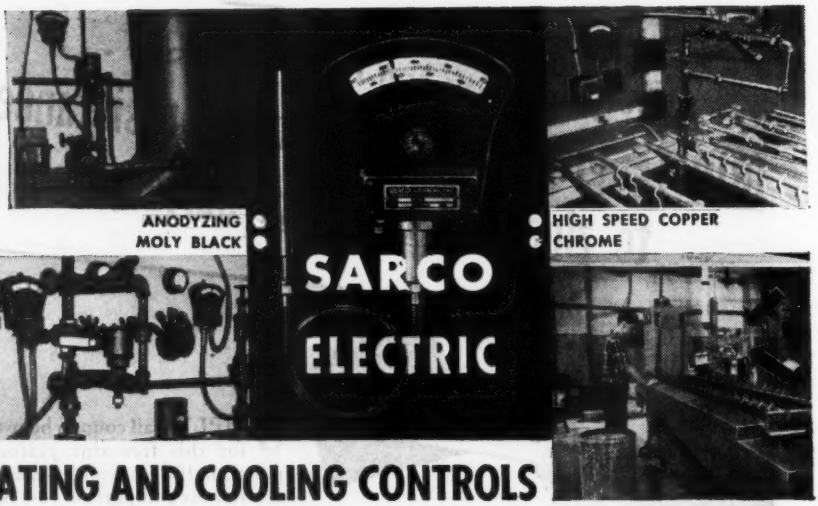


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# Colorimetric Methods as Applied to the Analysis of Electroplating Baths

D. Gardner Foulke & I. I. Horner

## IV. The Determination of Iron

Among the metals which occur as impurities in electroplating baths iron is very common. Most of these metallic impurities are easily assimilated as complex cyandies in the cyanide type baths, or even under conditions which limit their solubility, they are often codeposited with the solution metal from nickel and cobalt baths. Platers in general hold varying opinions as to the effect of iron when present even in moderate amounts in most electroplating baths. Iron causes pitting when present in nickel baths.[1] It is generally conceded that iron is undesirable in bright baths and that certain objectionable properties may be imparted to electroplate as a result of the codeposition of iron with nickel and copper.

Little information is available concerning the effects of traces of iron in electroplating baths and electrodeposits. The colorimetric method for determination of iron proposed in this article provides a means of rapid measurement of small to moderate quantities and presents a tool to aid the electroplater investigating the effects of small amounts of iron. It also provides a means for closer control of plating baths, which is in accordance with recent trends.

Methods other than colorimetric involving the direct determination of iron in nickel, cobalt, copper and zinc baths can be carried out gravimetrically by precipitation with ammonium hydroxide, separation of the ferric hydroxide, ignition and weighing as the oxide. Volumetric methods include an ammonia separation followed by [illegible] and titration with standard permanganate or some other oxidizing agent.[2] These methods are either impractical or inaccurate for the measurement of such small quantities of iron as this work is concerned with.

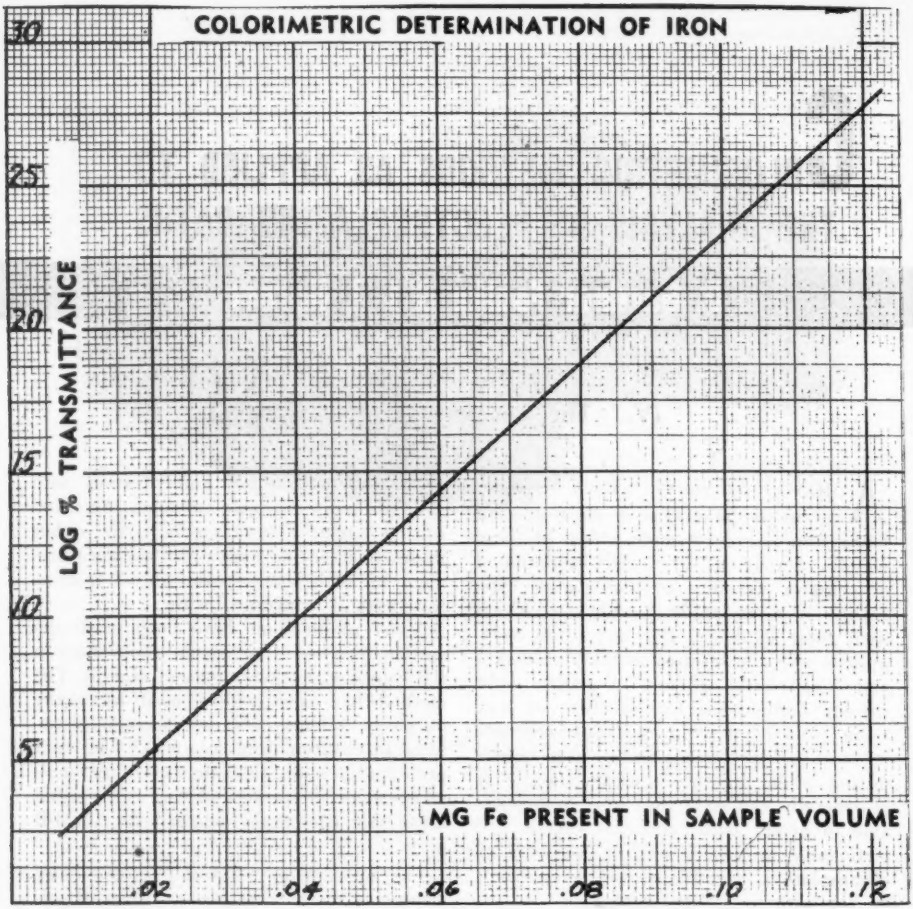
Many publications have been made describing the use of potassium thiocyanate in the colorimetric determination of iron. The method has been widely used for many purposes and may also be successfully applied to electroplating solutions.[3] The data presented here are the summary of measurements made on various plating baths using the Fisher Electrophotometer with a 525-B filter.

The instrument calibration is made by measuring the percent transmittance of solutions containing different concentrations of ferric ions as added from a standard solution made by dissolving a known weight of reagent grade iron wire (Note 1). The following procedure outline is adaptable both for calibration and analyses:

*a.* Pipette an appropriate sample of the solution to be analyzed into a 50 ml. beaker. Add three drops of concentrated nitric acid and boil to oxidize iron to the ferric state.

*b.* Cool and transfer to a 100 ml. volumetric flask. Add 25 ml. of hydrochloric acid — peroxide reagent, (Note 2).

*c.* Dilute to less than 75 ml., then add 25 ml. of potassium thiocyanate solution. (Note 3). Make up to the mark with distilled water and mix.




*d.* Measure the percent transmittance against a blank containing the reagents diluted to 100 ml. in a volumetric flask.

*e.* Read the milligrams of iron in the volume of sample taken from the graph prepared by using standard iron solution. If the pH and the concentration of the KSCN, is controlled in the solution used to measure transmittance, consistent results are obtained. The iron-thiocyanate color is unstable and fades rapidly. A small amount of hydrogen peroxide helps to stabilize the color.[4] The Electrophotometer readings must be taken immediately after the reagents are mixed.

TABLE I

Calibration of Electrophotometer

| Mg. Fe in Std. | Scale A Reading |
|---|---|
| .020 | 5.3 |
| .040 | 9.8 |
| .060 | 14.5 |
| .100 | 23.1 |

Three different nickel baths were analyzed and results obtained as shown in Table II. Additions of iron were made from the standard iron solution. The green color of the 525-B filter minimizes the effect of the colored nickel ion, and it is therefore possible to make direct measurements on the solution providing the color is not too deep. As much as 5 ml. of an

ordinary Watts bath may be used without appreciable error.

**TABLE II**

**The Determination of Iron in Nickel Baths**

| Nickel Bath | Mg. Fe Present | Mg. Fe Added | Average Reading | Mg. Fe Found |
|---|---|---|---|---|
| A | | .000 | 1.8 | .005 |
| A | .025 | .020 | 6.7 | .026 |
| A | .045 | .040 | 11.2 | .046 |
| A | .065 | .060 | 15.7 | .066 |
| B | | .000 | 1.7 | .004 |
| B | .024 | .020 | 5.8 | .022 |
| B | .044 | .040 | 10.5 | .043 |
| B | .064 | .060 | 15.1 | .063 |
| C | | .000 | 2.8 | .009 |
| C | .029 | .020 | 7.5 | .029 |
| C | .049 | .040 | 12.0 | .049 |
| C | .069 | .060 | 16.5 | .069 |

Bath C in Table II contains a red colored addition agent as a brightener. In this and similar cases it is necessary to use a volume of the bath equal to that taken for analysis to make up the blank. No potassium thiocyanate is used in this type of blank. It is therefore necessary that the reagents be iron-free. When the addition agent color is destroyed by oxidation, this procedure is unnecessary. Any material present in the bath which absorbs light near a frequency of 525 mμ will interfere with this determination unless a blank is used as previously described.

Anions which form iron complexes as fluoride, oxalate, metaphosphate and pyrophosphate cause interference. Cations like silver, mercurous, mercuric, cadmium, copper and antimony likewise interfere. Some ions do not cause trouble below certain concentrations.

Using the same procedure, acid zinc baths were analyzed as shown in Table III. Cyanide zinc baths can be successfully analyzed in the same manner if the cyanide is first removed.

**TABLE III**

**The Determination of Iron in Zinc Baths**

| Plating Bath | Mg. Fe Present | Mg. Fe Added | Mg. Fe Found |
|---|---|---|---|
| Acid Zinc | 0 | .000 | .000 |
| Acid Zinc | 0 | .020 | .020 |
| Acid Zinc | 0 | .040 | .037 |
| Cyanide Zinc | 0 | .000 | .000 |
| Cyanide Zinc | 0 | .020 | .021 |
| Cyanide Zinc | 0 | .040 | .038 |

Analysis of copper and chrome plating baths would probably involve a separation of the iron. Descriptions of these procedures will be reported at a later date.

This method of analysis is rapid and accurate for the conditions to which it is applied in this study. To insure successful application, the following points must be observed: (a) since iron is so commonly present in most materials, extreme care must be taken to prevent contamination of the reagents and apparatus: (b) measurements must be made rapidly; (c) blanks may be used for several hours if no appreciable red color is developed when they are first prepared; (d) the pH and thiocyanate concentrations must be controlled; (e) the transmittance vs. concentration range for ferric thiocyanate follows Beer's Law only in the lower scale readings. Readings within the range shown on the graph may be safely used.

**NOTES:-**

1. *Standard Iron Solution.* Weigh out 1000 mg. of reagent grade iron wire. Dissolve in 50 ml. of 1:3 nitric acid. Boil to expel oxides of nitrogen and dilute to 1 liter with distilled water. Further dilutions should be made with .2 N nitric acid (iron free).
2. *Hydrochloric acid — hydrogen peroxide reagent.* Add 166 ml. of concentrated C.P. HCl to a 2 liter volumetric flask. Add 1.6 ml. of 30% hydrogen peroxide. Make up to the mark with distilled water. Test the acid for iron by mixing 10 ml. of the concentrated acid with 10 ml. of the KSCN solution and 20 ml. of C.P. acetone. If no appreciable color develops the acid is sufficiently pure.
3. *Potassium thiocyanate solution.* Weigh out 120.0 grams of C.P. KSCN and make up to 1 liter in a volumetric flask. Test the salt for iron by adding 10 ml. C.P. acetone to 1-2 grams of the salt. If no appreciable color develops, the salt is sufficiently pure.

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# THE FUNDAMENTALS OF CHEMISTRY FOR ELECTROPLATERS

## PART XVII

## PROPERTIES OF SOLUTIONS

Samuel Glasstone, D. Sc. Ph. D.

### Vapor Pressure and Evaporation

APART from the chemical properties which are characteristic of the particular solute, all solutions have certain physical properties in common; a study of these properties has thrown much light on the nature of solutions. The physical study of solutions may be based fundamentally on a property of the solvent, i.e., the water, known as the "vapor pressure." All liquids, and even solids, have a tendency to evaporate if left in an open space. A puddle of rain water, for example, will disappear, due to evaporation, after a day or two of dry weather. The liquid water is gradually converted into a gas or "vapor" which leaves the surface of the liquid and is thus dispensed. At high temperatures the water vapor is more familiarly known as "steam." Actually water vapor is invisible, like most other gases, and it is the reconversion of the vapor back to droplets of liquid water upon cooling, i.e., condensation, which renders the steam visible. Water vapor (or steam) is thus evolved from the surface of liquid water at all temperatures, although the rate of evolution, that is, evaporation, increased very rapidly as the temperature is raised.

The tendency of a liquid to evaporate at any temperature is measured by its "vapor pressure." The latter is equal to the maximum (or saturation) pressure that can be exerted by the vapor when the liquid is placed in a closed vessel. The vapor is evolved from the surface of the liquid, but now instead of being dispersed, as it would be if the vessel were open, it accumulates and gradually builds up an excess pressure. The maximum value of this pressure at a given temperature is the vapor pressure of the liquid at that temperature.

### Vapor Pressure and Boiling Point

The vapor pressures of many liquids have been measured at various temperatures, and the results are recorded in tables. It has been found that the vapor pressure invariably increases as the temperature is increased. The temperature at which the vapor pressure of a liquid becomes equal to the pressure of the external atmosphere is what is known as the "boiling point" of the liquid. Thus water is said to boil at 100° C at atmospheric pressure, because the vapor pressure of water is then equal to 1 standard atmosphere, that is 29.92 inches or 76.0 cm. of mercury. If the pressure of the external atmosphere is lowered deliberately, for example by producing a partial vacuum above the liquid, the latter will boil at a lower temperature than the standard boiling point. This fact is frequently used in industry for the evaporation of liquids at relatively low temperatures. Incidentally, since the pressure of the atmosphere decreases with increasing elevation above sea level, the boiling point of water decreases at the same time. Because of the lower temperature of boiling water, it takes longer to cook an egg to the same degree of hardness in Denver than it does in New York or San Francisco.

### The Boiling Points of Solutions

One of the characteristic properties of a solution is that the vapor pressure is less than that of the pure solvent; thus, the pressure of water vapor above a solution of sugar, sodium chloride, nickel sulfate, etc., is less than that over pure water at the same temperature. As a consequence, it is necessary to raise the solution to a higher temperature than would be required for the pure solvent before it will boil at

atmospheric pressure. It follows, therefore, that the boiling point of an aqueous solution must be higher than that of pure water. Both experimental and theoretical studies, extending over many years, have established the fact that the increase (or rise) of the boiling point is proportional to the number of molecules of the dissolved substance, irrespective of its nature, present to a given weight of solvent. Thus, one molecular weight expressed in grams, usually referred to as "one mole" of any substance dissolved in 1000 grams of water will raise the boiling point by 0.52, that is, from 100° to 100.52° C. One consequence of this result is that it is possible to determine the molecular weight of any substance in solution by measuring the increase of boiling point at a known concentration, i.e., one containing a known weight of solute to 1000 grams of solvent. Consider, for example, a solution containing 49 grams of a given solute to 1000 grams of water. If this boils at 0.35° above the boiling point of pure water, it contains 0.35/0.52 molecular weights (in grams) to 1000 grams of water; since this is actually 49 grams, it follows that the molecular weight of the solute must be 49 × (0.52/0.35), i.e., 73.

### The Freezing Points of Solutions

Another, although less obvious, consequence of the vapor pressure of a solution being lower than that of the solvent, is that the solution will commence to freeze at a lower temperature than does the pure solvent. This lowering of the freezing point of a solution, like the rise of boiling point considered above, depends only on the number of molecules of solute, irrespective of their nature, present in a given amount of solvent. The actual values of the lowering of the freezing point and the rise of boiling point of a given solvent, e.g., water, are, however, usually quite different. Thus, pure water freezes at 0° C, but a solution of one mole, i.e., one molecular weight in grams, of solute in 1000 grams of water will commence to freeze at —1.86° C; the lowering of freezing point is then 1.86° per mole of dissolved substance in 1000 grams of water. From this figure it is possible, just as in the case of the rise of boiling point, to determine the molecular weight of a solute from a measurement of the freezing point of a solution of known concentration.

### Molecular Weights of Electrolytes

The foregoing methods have been employed to evaluate the molecular weights of numerous substances in solution, and in many cases the results are in complete agreement with those to be expected from other considerations. However, for solutions of certain acids and bases and of the great majority of salts, the values of the molecular weights obtained from the rise of boiling point or the lowering of the freezing point are considerably less than would have been anticipated. For instance, sodium chloride has the formula NaCl; the atomic weight of sodium (Na) is 23.0 and that of chlorine (Cl) is 35.5, and so the molecular weight should be 58.5. Nevertheless, the molecular weight in solution is found to be about 30, i.e., approximately half the expected value. Similar results have been obtained for other salts, such as silver nitrate ($AgNO_3$), nickel sulfate ($NiSO_4$), potassium cyanide (KCN), and also for some acids, e.g., hydrochloric acid (HCl), and bases, e.g., sodium hydroxide (NaOH). In some cases, e.g., sulfuric acid, the molecular weight in solution approximates to one-third of the value based on the formula $H_2SO_4$. The same is true for sodium carbonate ($Na_2CO_3$), sodium sulfate ($Na_2SO_4$), zinc chloride ($ZNCl_2$), etc.

### The Theory of Ionic Dissociation

In seeking for an interpretation of these abnormal values of the molecular weights of acids, bases and salts in solution, the Swedish scientist, Svante Arrhenius, pointed out in 1887, that these solutions had one property in common: they were all good conductors of the electric current. Solutions which conduct electricity are called "electrolytes," and hence it is concluded that electrolytes behave abnormally as far as the vapor pressure properties of the solution, such as rise of boiling point and lowering of the freezing point, are concerned. It had long been accepted that the electric current is carried through a solution by electrically charged particles called "ions," but no satisfactory explanation had been offered for the origin or formation of these ions. Arrhenius suggested that when a salt, or acid or base, which

forms an electrolyte, is dissolved in water, it splits up instantaneously and almost completely into positive and negative ions. For example, when sodium chloride is added to water it splits up or "dissociates" to form positively charged sodium ions ($Na^+$) and negatively charged chloride ions ($Cl^-$). The positive charge on the sodium ions is equivalent to the negative charge on the chloride ions so that the solution remains electrically neutral. In a similar manner, according to the theory of Arrhenius, nickel sulfate dissociates largely in solution to form nickel ions ($Ni^{++}$) and sulfate ions ($SO_4^{--}$). Other electrolytes would split up into positive and negative ions in an analogous manner.

It is now possible to explain the unusual nature of the results obtained in connection with the determination of molecular weights in solution. It was stated above that the rise of boiling point or lowering of freezing point was determined by the number of molecules present in the solution. This conclusion may be generalized so that the "number of molecules" implies the total number of molecular particles, *including ions*. Hence a solution which was believed to contain, for example, one mole of sodium chloride actually contains almost two moles of sodium and chloride ions. The rise of boiling point and lowering of freezing point will consequently be about twice the expected value, and this should give an apparent molecular weight of half the result based on the formula NaCl, as is actually found to be the case. Whenever one molecule of any substance dissociates into two ions in solution, e.g., hydrochloric acid (HCl), nickel sulfate ($NiSO_4$), etc., the molecular weight approaches half the expected value. On the other hand, if three ions are formed from each molecule, e.g., sulfuric acid ($H_2SO_4$) which gives two hydrogen ions ($2H^+$) and one sulfate ion ($SO_4^{--}$), and sodium carbonate ($Na_2CO_3$) which dissociates into two sodiums ions ($2Na^+$) and one carbonate ion ($CO_3^{--}$), the molecular weight in solution will appear to be about one-third of the value derived from the formula.

### Anions and Cations

The theory of ionic dissociations, as outlined above, is of fundamental importance to electrochemistry and electroplating. The subject is dealt with more fully in Chapters I, II and III of "The Fundamentals of Electrochemistry and Electrodeposition" published by the American Electroplaters' Society. For the present, however, it is sufficient to bear in mind that electrolytic solutions consist largely of ions formed by the spontaneous dissociation of the solute, e.g., a salt, acid or base.

Under the influence of an electrical force (E. M. F.), produced by a battery or dynamo, the ions are caused to move through the solution, the positive ions in one direction and the negative ions in the other. The negative ions move toward the positive electrode or "anode;" they are consequently referred to as "anions." The positive ions, on the other hand, travel to the negative electrode or "cathode," and so they are referred to as "cations." These terms will be used from time to time in the succeeding articles.

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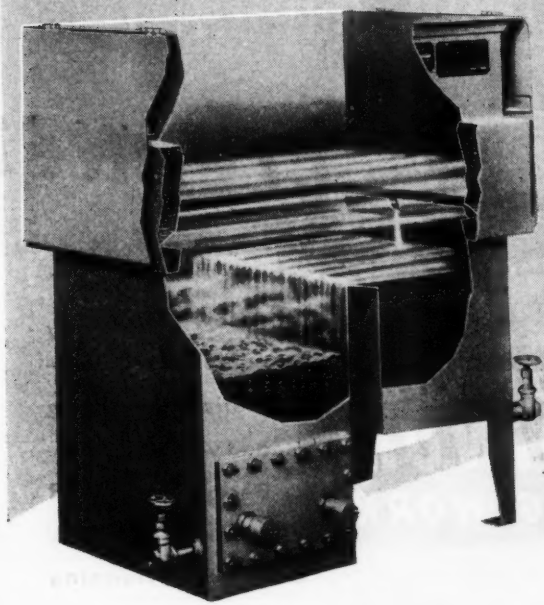

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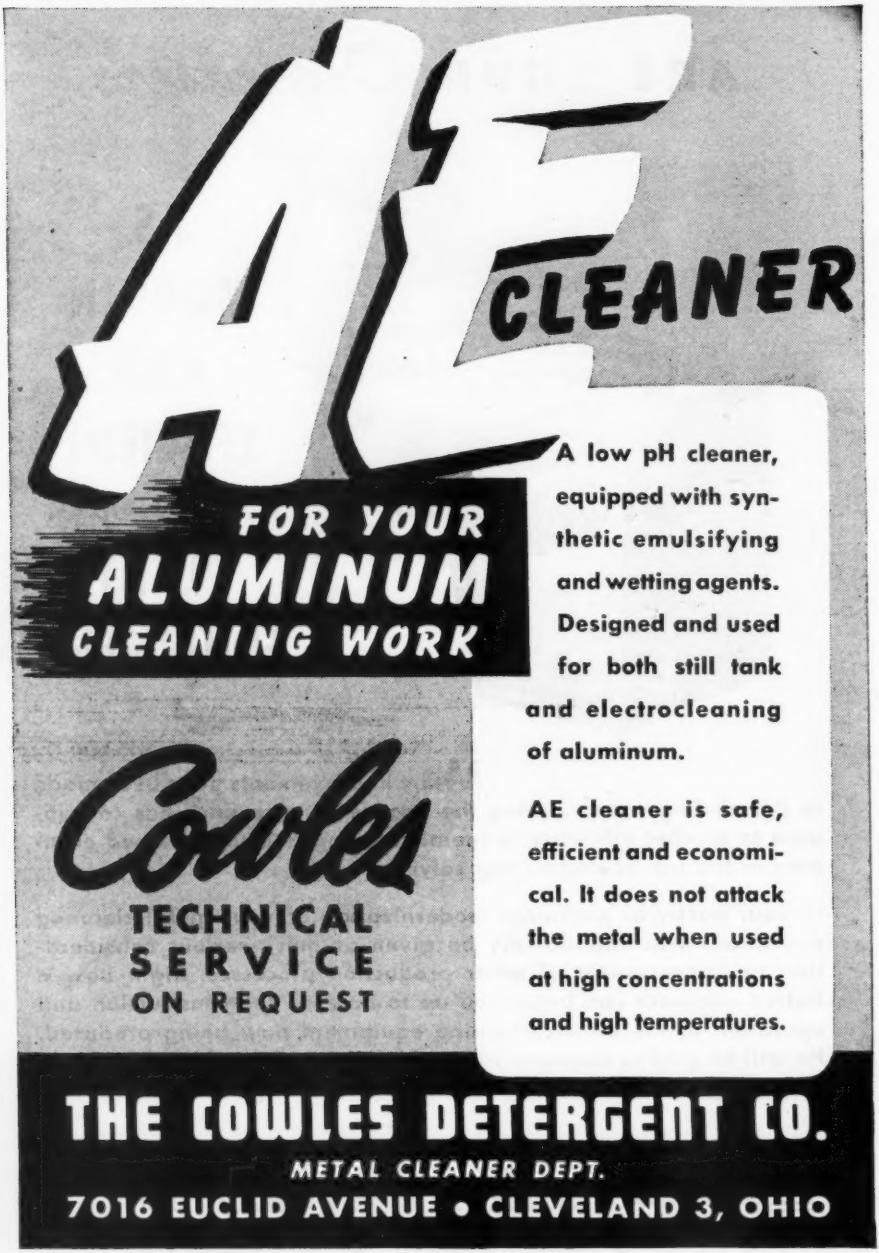
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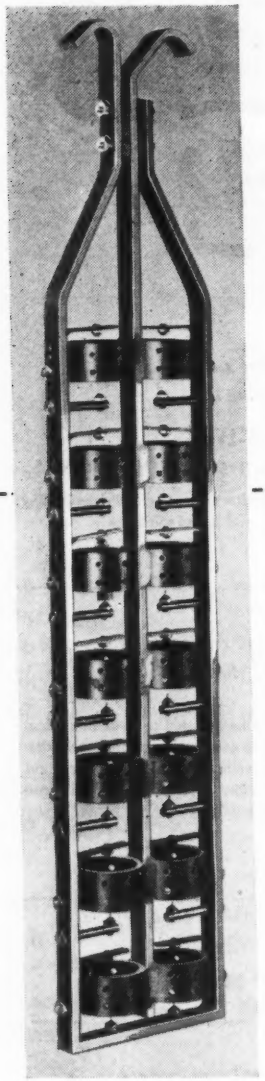

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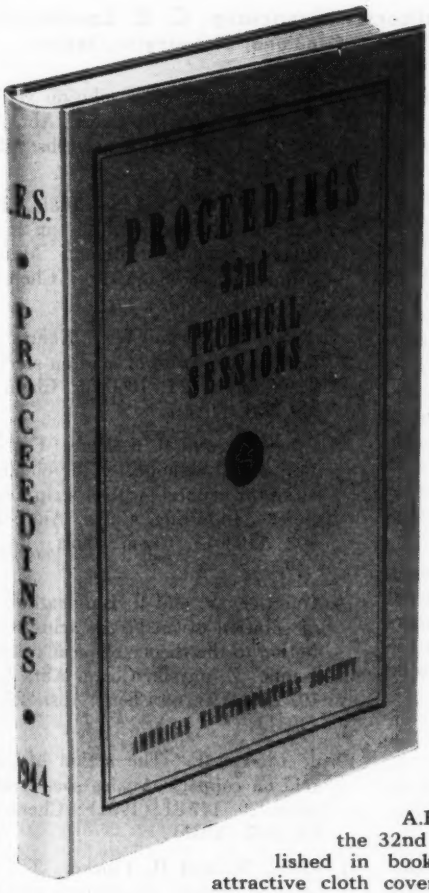


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# Progress Report Number One: A. E. S. Research Project Number 1, on "STRIPPING OF COPPER FROM VARIOUS BASE METALS"

**Project Director: F. C. Mathers. Associate: C. E. Landwerlen,**
**Chemistry Department, University of Indiana, Bloomington, Indiana**

THIS is the first progress report on the study of "Stripping of Copper from Various Base Metals." First to collect and then to analyze all available published data are the initial steps in carrying out the project. Although the published work on stripping is very meager, there is very extensive literature on corrosion and pickling of metals with special emphasis on inhibiting agents which, in some cases, reduce the action of acids on iron by as much as 98% without seriously interfering with the solubility of the oxide scale. Some references on this subject are given in the following bibliography because of its close relationship to stripping and the fact that the research will attempt to make use of these ideas for the development of new solutions for stripping.

The bibliography is not fully completed. The sub-committee asks that any additional references on this subject known to readers be submitted to the project director for use in writing a critical abstract which is to be prepared for a later publication.

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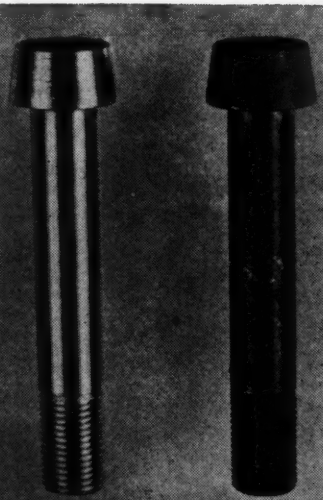

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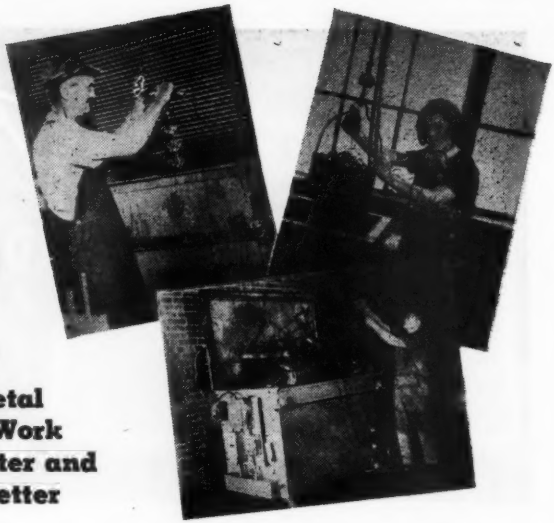

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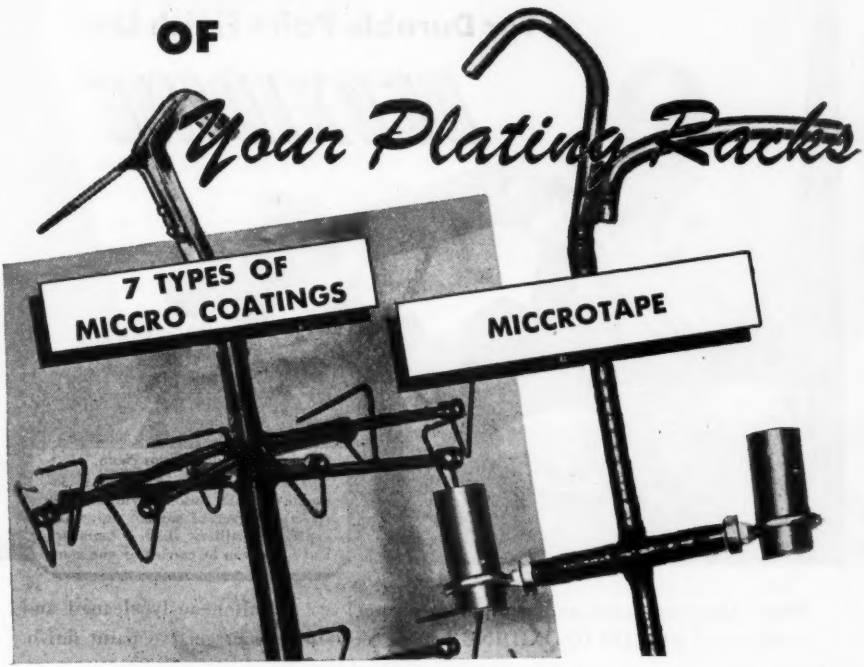


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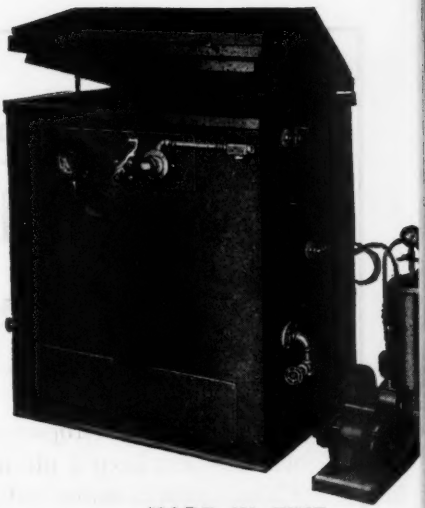

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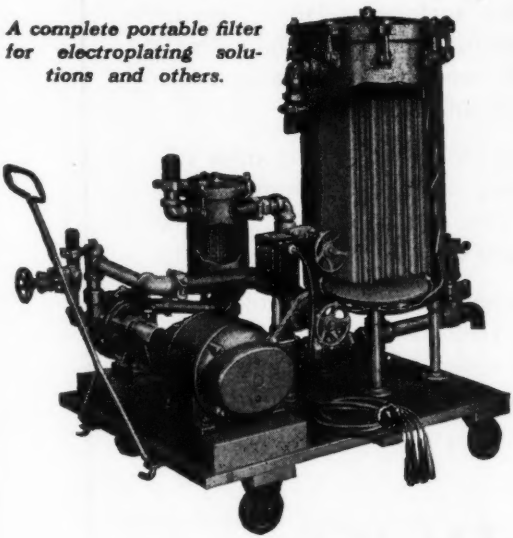

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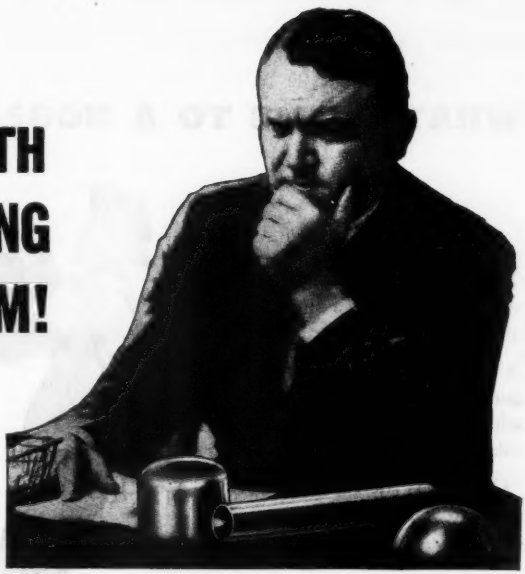

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# EDUCATIONAL SESSIONS

## Rockford Educational Session

The American Electroplaters Society of Rockford, Illinois is proud to announce their THIRD ANNUAL EDUCATIONAL SESSION AND BANQUET.

The Educational Session will be held in Woodward Governor's modern windowless plant, 5001 North Second Street, from 2 P.M. to 5 P.M. At this time the following papers, which should be of universal interest, will be presented and discussed:

"Speedy and Efficient Methods for Stripping Copper, Copper Alloys, Cadmium, Zinc, Tin, Chromium, Nickel, and Silver," by Elmore Relitz, of United Chromium, Incorporated, Detroit, Michigan.

"Rack Insulation and Stop-Offs in the Plating Room," by S. Fabry, of Belke Manufacturing Company, Chicago, Illinois.

"Electrodeposition of Hard Chromium for Wear Resistance," by Dr. D. A. Cotton, Research Director, Delco-Remy Division, General Motors Corporation, Anderson, Indiana.

An informal Dinner Dance and Entertainment will follow at the Faust Hotel promptly at 6:30 P.M.

The subjects of The Educational Session speak for themselves. The committee has done everything to insure all a good time at the banquet and dinner dance. We are interested in having the largest possible representation from each organization. This is your invitation to attend both The Educational Session and Banquet. The committee would appreciate having all reservations in by March 14th. *Don't forget the date,* SATURDAY, MARCH 24, 1945. Tickets $3.50 per person.

## Newark Educational Session

The Newark Branch of the American Electroplaters' Society wishes to announce that due to prevailing conditions the annual banquet, which was to be held on April 7, 1945, has been cancelled.

The Educational Session, which was to preceed the banquet, will be held on Friday, April 6, 1945 at 8:30 p.m. at the Robert Treat Hotel in Newark, N. J. This Spring Educational Session, under the sponsorship of the Educational Chairman with the aid of the committee, will furnish you — as several past open meetings of this type have proven — with valuable information on pertinent subjects. We have been fortunate to have with us on this day three outstanding speakers, who are well qualified to make the evening entertaining and informative.

George B. Hogaboom, Consultant, New Britain, Conn. Subject: What Specifications Have Taught Us About Electroplating.

Andrew Wesley, International Nickel Co., Bayonne, N. J. Subject: To be announced.

W. B. Sample, Bell Telephone Lab, New York, N. Y. Subject: To be announced.

The Newark Branch wishes to extend a cordial invitation to everyone engaged in electroplating and its allied industries to attend.

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# BOOK REVIEWS

## DR. GEORGE DUBPERNELL

### *Commercial Waxes—Natural And Synthetic*

H. Bennet — 583 pages. Chemical Publishing Co., Inc., Brooklyn, N. Y., 1944. Price: $11.00.

An up-to-date book on waxes is much needed at the present time because of the increasing use of materials of this type, and the wide variety of new products placed on the market in recent years. The present book goes a long way towards filling this need, although one might expect a more thorough-going and complete treatise for the high price charged.

The first part of the book comprising 266 pages includes the type of data about waxes which one would expect. The first chapter covers Natural Waxes, including Mineral, Vegetable, Animal, and Insect Waxes. The second chapter on Manufactured and Synthetic Waxes discusses Fatty Alcohols, Fatty Acids, Polyglycols, Polyhydric Alcohol Fatty Acid Esters, Hydrogenated Oils, Chlorinated Naphthalenes, Acrawaxes, I. G. Waxes, Miscellaneous Synthetic Waxes, Ketones, Amines, Amides, Nitriles, and Santowaxes. Chapter Three gives data on the Physical Properties of Waxes and Wax Compositions, while chapter Four relates to Wax Technology.

A second part of the book (Chapter V) is called "Waxes in Industry," and covers pages 267 to 377. It consists of a series of 34 separate articles written by various industrial experts or quoted from other books, patents or articles. As might be expected, these 34 articles vary somewhat in quality and are rather unrelated to the rest of the book. They often deal in generalities and many might be considered "padding" rather than adding to the technical information. The section on Electroplating on pages 335-336 by C. B. F. Young is typical, and is too brief to be of value. It discusses only the general features of rack insulation and stopping off, and the properties of a theoretical wax for plating.

Chapter Six consists of Tables and a Glossary, and extends from page 378 to page 395. It would be better associated with the first part of the book up to page 266, in the reviewer's opinion.

In view of the six-volume Chemical Formulary written by the same author, one is not surprised to encounter a long fourth part of the book extending from page 396 to page 563, and labelled the Wax Formulary. This seems only slightly less of a hodge-podge than the collections of formulae in the Chemical Formulary. These formulae may be useful and interesting to many purchasors of the book, but in the reviewer's opinion many others would prefer and expect a more detailed discussion of the properties and methods of using the various waxes available.

The Formulary is followed by a four-page appendix on Substitutes. A somewhat saving grace of the book is a rather complete index which also indexes the Formulary. While this index is a good one, it does not appear to be entirely complete and

# ANNUAL CONFERENCE

On Monday, February 13th, 1945 the Pittsburgh Branch of the American Electroplaters Society was officially notified by the Office of Defense Transportation that the application to hold a National A.E.S. Conference in Pittsburgh during the month of June 1945 had been rejected.

Therefore, in accordance with the policy of the organization to cooperate fully with the Government, Pittsburgh regretfully announces that all plans for holding the 1945 Convention have been summarily abandoned.

However, Pittsburgh regards this as a postponement and not a cancellation and desires the privilege of being host at the first Annual A.E.S. Convention after O.D.T.'s ban is lifted.

A meeting of the Convention Committee is scheduled and any important development transpiring at the session will be announced at the earliest possible date.

W. J. HENNESSY,
*Publicity Chairman*

some details are not easily located by means of it.

This book on waxes can be recommended if the above described limitations are kept in mind and one does not expect too much for the high price. A more exacting purchaser of Technical books without a compelling need would probably prefer to wait for the publication of other books on this subject and compare them to this one. This book by Bennett seems somewhat lacking as a detailed reference book of permanent value. If it contains the information one needs it may prove to be invaluable, but if one expects to find certain detailed information regarding a specific wax or application one is apt to be disappointed.

## Daniels Appoints Enthone

The Daniels Plating Barrel Co., 129 Oliver St., Newark, N. J., announce the appointment of the Enthone Company, 422 Elm St., New Haven, Conn., as their exclusive sales agents for the New England territory. Enthone will distribute equipment manufactured by The Daniels Plating Barrel Company.

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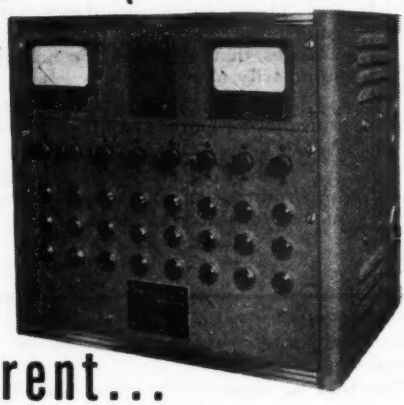

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# INDUSTRY NEWS

## W. H. Webb Advanced in Detrex Alkali Division

L. C. Camel, Sales Manager of the Alkali Division of Detrex Corporation, Detroit, has just announced the appointment of W. H. Webb to Assistant Sales Manager. Beside alkali and emulsion cleaning compounds, the Company produces solvent degreasers, metal parts washers, chlorinated solvents, drycleaning machines and oil-extraction plants.

Mr. Webb will move to the Detroit office from Indianapolis where he was the manager of the Indiana Division. He joined the Detrex organization in 1942 and handled the Michigan territory, exclusive of Detroit until he went to Indianapolis. Mr. Webb was active in the major appliance field for a number of years prior to his association with Detrex, and brings considerable experience in metal cleaning and sales capacities to his new post.

Mr. Webb is a charter member of the Jackson-Lansing Branch of the American Electroplaters' Society and held the office of librarian of the chapter in 1942 and 1943.

W. H. Webb

## Bellinger Made V. P.

The Chemical Corporation takes pleasure in announcing that Mr. Kenneth P. Bellinger of Hartford, Conn., was duly elected a Vice-President of the Corporation at its Annual Meeting.

## Prime Plating Works Established

Mr. Irving Goldwasser has announced the establishment of his own plating plant to be known as Prime Plating Works, located at 124 Baxter Street, New York City.

Mr. Goldwasser is an active member of the New York Branch of the A.E.S. Connected with the plating industry for the past 10 years with a background of special chemical courses at Pratt Institute.

Formerly connected with Wright Aeronautical at Paterson, N. J.

Dr. Price

## Price To Oakite

Dr. Donald Price, formerly associated with the Interchemical Corporation and National Oil Products Co., author of many technical papers on organic chemistry and well known for his research work on sulphonated oils, wetting agents and detergents, has been appointed Technical Director of Oakite Products, Inc., New York, manufacturers of specialized industrial cleaning materials. Dr. Price will direct the activities of the Company's chemical and engineering staff and Research Laboratory in connection with plans to expand its technical service facilities to all branches of the metal working industry and in the further development of materials designed for the improved surface preparation of metals. Dr. Price is Vice-President of the American Institute of Chemists, Councillor of American Chemical Society, member of the Executive Committee, American Branch, American Institute of Chemists and various professional societies.

## Cowles Announces Profit Sharing Plan

The Cowles Detergent Company of Cleveland, Ohio has announced to its employees the establishment of an Employees' Profit Sharing Trust. The trust which became effective for the year 1944 has received government approval and will benefit all employees who are compensated on a straight salary, or salary and commission, or straight commission basis.

To become eligible for participation in the plan, an employee must complete two years of continuous employment unless granted a leave of absence by the company. Employees in the Armed Forces are deemed to be on a leave of absence so that this does not effect their eligibility under the plan.

There are no deductions from the employees compensation as the entire cost is paid by the company. Briefly, the plan provides that a predetermined return on the net worth of the company shall first be deducted from the yearly profit, computed before federal income and excess profits taxes, and 20% of the remainder shall be placed in trust for the eligible employees. Allocation of this fund to the individual participants is made on the basis of the ratio of their annual income to the total income of all participants. The fund is being administered by the Cleveland Trust Company as Trustee, and a committee of three employees appointed by the Directors of the company. Income from investments of the trust funds accrues to the credit of the participants.

Distribution of the fund is made to each participant upon retirement either in a lump sum, deferred payments or in the form of an annuity insurance policy. Participants leaving the employ of the company after completing ten years of participation under the plan receive their full equity in the trust. Those leaving before completing ten year participation sacrifice a portion of their equity depending on the length of their employment.

The contribution to the trust for the year 1944 amounts to a substantial portion of each participants income for that year. The benefits from this trust plus those provided by the federal social security program should provide an adequate retirement income for Cowles' employees who have been eligible to participate in the plan.

## Lea Earns Army-Navy Star

Long before Pearl Harbor The Lea Mfg. Co. began applying its many years of experience in composition development to producing special burring compounds for defense and then for war. The first "E" award was proud recognition of the devotion and skill of all LEA workers, and the star now added is proof that our pledge, to continue working without stint, has been ably kept. We pledge to keep on earning stars until the war need has passed . . . *until victory is complete and permanent.*

## Bulletin 405

U. S. Stoneware, Akron, Ohio, announce Bulletin 405 is ready for distribution, copies of which may be had without charge by writing to the PROCESS EQUIPMENT DIVISION. Bulletin features tanks, jars, pots, trays, suitable for storage and mixing for acids and corrosive materials.

## Phosphor Bronze Booklet

Seymour Manufacturing Company, Seymour, Conn., announce a new booklet on Phosphor Bronze ready for distribution. Copies may be obtained without charge by writing the company direct.

## United Platers Announces Several Staff Promotions

Promotion of several executives and additions to the staff of United Platers, Inc., of 994 Madison, are announced by Glenn H. Friedt, president and general manager. *James J. Malone,* who served the firm in various capacities during the past 10 years, was advanced to the post of assistant general manager. He had charge of the sales division, prior to the war. He holds membership in the Detroit Electroplaters' Society and the Plating and Rustproofing Association of Michigan.

*Edward W. Tawyea,* has been promoted from superintendent to general superintendent. He has been associaed with United Platers for 18 years during which time the firm progressed from a small organization to one of the largest job plating plants in Michigan.

**James J. Malone**

*George D. Blair,* formerly assistant sales manager, was made manager of the sales division. He has been with the company for seven years. Prior to our entrance into war he had completed plans to convert the sales staff into a service organization to expedite the flow of critical war materials to war plants.

*W. Meyer,* previously office manager, has been promoted to comptroller.

*Clarence Norris,* who was associated with the U. S. Rubber Company for the past 16 years has been added to the technical staff of United Platers, Inc. Mr. Norris conducted extensive research work on the rub ber to metal adhesion process through the medium of brass plating which method is now being largely used on heavy war equipment for elimination of vibration.

Promotion of *Walter E. Kolemainen,* to the post of assistant superintendent also was announced. He holds a degree in chemistry from St. Olaf's College, Minnesota, and is a post graduate of Wayne University. He was a former superintendent of Westinghouse Naval Ordnance.

Services performed by the United Platers, Inc., include all phases of electroplating, rustproofing, mechanical burnishing, anodizing, hot lead coating, heat treating and sand blasting.

## WALTER PINNER

*Chairman, Program and Educational Committee*

### A Study of Impurities in Cobalt Electrowinning

By RUTH E. CHURCHWARD, F. K. SHELTON and R. G. KNICKERBOCKER. Electrochemical Society—Preprint 85-10 for meeting of April 13-15, 1944, p. 101-120.

In electrolyzing a standard fluoborate electrolyte containing 20 g./L. cobalt as $CoSO_4$, 50 g./L. boric acid, and 5 g./L. NaF at 25 amp./sq. ft. (2.7 amp./dm.), using lead anodes and stainless steel cathodes, the maximum tolerance for the metallic impurities for the production of satisfactory 7-hour cobalt electrodeposits is in mg./L.: zinc 10 cadmium 1; arsenic (trivalent) 3; arsenic (pentavalent) 1; antimony (trivalent) 10; mercury (divalent) 1. Trivalent and hexavalent chromium in concentrations up to 100 mg./L. were only slightly harmful, while nickel, copper, iron, and manganese were not found deleterious. The impurities may be removed by: (1) recrystallization of $CoSO_4$; (2) recrystallization of $CoSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$; or (3) precipitation of the impurities with $H_2S$ under 20 lb./sq. in. (1.4 kg./cm.) in solutions of a pH 4.0, followed by the familiar iron purification.

VINCENT MATTACOTTI, FRANK K. SAVAGE

### The Effect of Specimen Position on Atmospheric Corrosion Testing of Steel

By C. P. LARRABEE. Electrochemical Society—Preprint 85-8 for meeting April 13-15, 1944, p. 86-91.

Many methods of exposing atmospheric corrosion test speciments are described. It is shown that steel specimens, when mounted on racks at an angle of 30° to the horizontal, corrode less on the surface exposed to the sky than on the side toward the ground. In applications such as roofs where the underside of the sheet is not exposed, the expected life might be two or more times that indicated by tests where both sides are exposed.

VINCENT MATTACOTTI, FRANK K. SAVAGE

### The Estimation of Ammonia in Electrolysed Cyanide Plating Solution

By C. M. BLOW, N. G. HISCOX, and M. W. SMITH. *Journal of the Electrodepositors' Technical Society*, 1944, **19**, 147-156.

For satisfactory control of brass plating bath conditions, a distinction is made between "free ammonia" and "total non-cyanide nitrogen" which latter also includes ammonium salts. cyanates, urea, etc. Methods of analysis for both have been worked out, and are discussed and compared with previously published methods for analysis of brass plating solutions fro ammonia.

L. B. SPERRY

### Wetting Agents — Their Use in Electroplating and Allied Processes

By H. SILMAN. *Journal of the Electrodepositors' Technical Society*, 1944, **19**, 131-146.

Wetting agents are discussed according to type, effectiveness, stability, uses, etc. Their use in alkaline cleaners, pickling solutions, aluminum deoxidizing solutions, plat-

ing solutions, and soldering fluxes ,is considered in particular.

L. B. SPERRY

### De-Burring

By H. LEROY BEAVER. *Products Finishing* 7, No. 12, 36-46 (1943).

De-burring, although adapted to many war articles, is not a new process. It is folly to think that all classes of parts lend themselves to barrel treatment although many parts, with proper die work, can be handled by this method. It is important to make test pieces for trial runs (before dies are made) since deburring does not remove the same amount of material at all points. The old foundry barrel with hard balls will not do. Rather, soft balls or soft, friable abrasives should be used. Some parts may need no cushioning at all. Since the proper pressure is most important, the same size barrel will be needed for small and large loads. Deformation generally occurs with excessive barrel speed. The class of work will determine the type of barrel. There is a short discussion of barrel vs. wheel along with suggestions for solving any particular problem.

HOMER G. MORTON

### The Determination of Gold in Plating Solution

Dr. C. B. F. YOUNG. *Products Finishing*, 7, No. 12, 22-32 (1943).

A discussion and description of various methods of determining gold in plating solution. The recommended procedure is given in detail.

HOMER G. MORTON

### Spray Painting Need Not Be Wasteful

By JOHN J. ZOLAND. *Products Finishing*, 7, No. 11, 28-40 (1943).

Sprayless in industrial finishing operations varies from 20% to as much as 80%. Water wash spray booths are advantageous in that the health and fire hazards are reduced along with the possibility of recovery of overspray. Critical materials may be saved if overspray is collected is reclaimable form by (1) keeping it wet, (2) preventing contamination, usin proper recovery agent, and (3) returning overspray to paint manufacturer in clean, sealed, openhead drums. The original paint manufacturer is the one most capable of reprocessing the reclaimed material.

### Solvents and Thinners for Synthetic Enamels

By JEFFREY R. STEWART. *Products Finishing*. 7, No. 11, 42-54 (1943).

Of all the ingredients or raw materials used in paints and enamels, the easiest one to test or evaluate is the thinner or solvent that is used to obtain the desired consistency. Without too much expense, equipment can be procured for the tests named below. General appearance, color, spot test, flash point, copper corrosion, distillation range, solvent power, acidity, amount of benzol, and aromatic hydrocarbons tests are the factors covered in the article.

### Plating Practices of the Aircraft Industry

From *Iron Age*, Vol. 154, **6**, August 10, 1944, p. 56.

This article is the result of a survey by the Lockheed Aircraft Corp. under the auspices of the Methods Improvement Panel of the Aircraft War Production Council.

It covers the use of zinc plating as a replacement for cadmium. Procedures for both zinc and cadmium plating are described, including the plating sequence from pre-cleaning, pickling, through the plating operations and passivation.

### Building Up Worn Parts by Electrodeposition

By A. W. HOTHERSALL, (Armament Research Dept., British Ministry of Supply), *Iron Age*. Vol. 154, **21**, Nov. 23, 1944, p. 47.

This article cites British practice in application of nickel and chromium for salvage of worn or mis-machined parts. The use of heavy nickel is claimed to have certain advantages over other methods of building up surfaces for repair.

The author reviews some of the technical factors relating to electrodeposition in general and contrasts the relative advantages of nickel and chromium plating, hardness and strength of deposits, adhesion, stresses uniformity, effect on steel rate of deposition are among the topics discussed in an informative and detailed manner.

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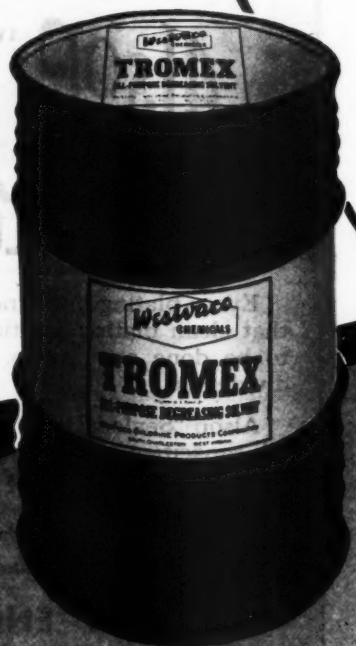

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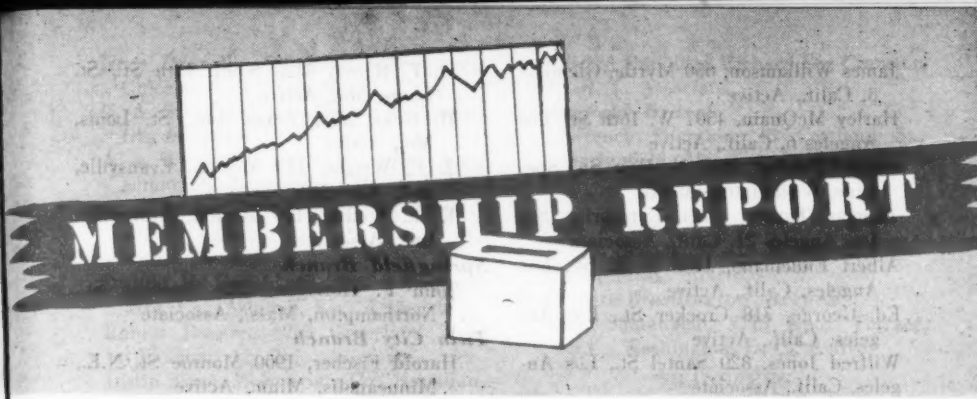


**FRANK K. SAVAGE**

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G. H. Carter from Chicago Branch to Los Angeles Branch

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***Detroit Branch***

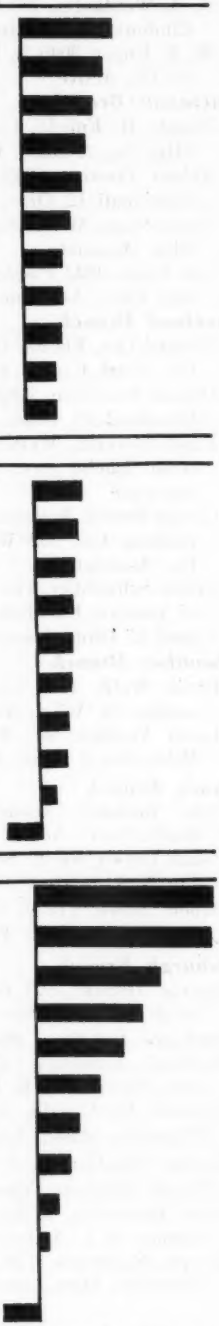
H. Grostick
T. Kirby
H. Hogan

***St. Louis Branch***

C. Koderhandt

# MEMBERSHIP CHART

| BRANCH | May 1944 | Change in Membership | Percent Change |
|---|---|---|---|
| **FIRST GROUP** | | | |
| LOS ANGELES | 123 | +27½ | +22.3 |
| CLEVELAND | 115 | +23 | +20. |
| BOSTON | 130 | +23 | +17.6 |
| DETROIT | 336 | +52½ | +15.6 |
| NEW YORK | 158 | +23 | +14.5 |
| HARTFORD | 114 | +13 | +11.4 |
| ST. LOUIS | 111 | +11 | + 9.9 |
| PHILADELPHIA | 138 | +13 | + 9.4 |
| WATERBURY | 111 | +10 | + 9. |
| NEWARK | 198 | +14½ | + 7.3 |
| CHICAGO | 323 | +23½ | + 7.2 |
| **SECOND GROUP** | | | |
| NEW HAVEN | 95 | +11 | +11.5 |
| BRIDGEPORT | 102 | +10½ | +10.2 |
| DAYTON | 100 | + 9½ | + 9.5 |
| MILWAUKEE | 97 | + 9 | + 9.2 |
| BALTIMORE-WASH. | 107 | + 9½ | + 8.8 |
| TORONTO | 109 | + 9 | + 8.2 |
| BUFFALO | 80 | + 6 | + 7.4 |
| GRAND RAPIDS | 109 | + 7½ | + 6.8 |
| ROCHESTER | 83 | + 3 | + 3.6 |
| SPRINGFIELD | 79 | — 6½ | — 8.2 |
| **THIRD GROUP** | | | |
| PROV.-ATTLEBORO | 66 | +29 | +43.9 |
| INDIANAPOLIS | 74 | +32 | +43.2 |
| TOLEDO | 42 | +13 | +30.9 |
| SYRACUSE | 51 | +13½ | +26.4 |
| JACKSON-LANSING | 51 | +11 | +21.5 |
| PITTSBURGH | 68 | +10½ | +15.4 |
| TWIN CITY | 39 | + 4 | +10.2 |
| MONTREAL | 50 | + 4 | + 8. |
| LANCASTER | 40 | + 2 | + 5. |
| SAN FRANCISCO | 39 | + 1 | + 2.5 |
| AUSTRALIA | 51 | — | — |
| CINCINNATI | 63 | — 5½ | — 8.7 |



Membership May 1, 1944 = 3385
Membership Mar. 1, 1945 = 4187½

Gain in Membership = 430
Per Cent of Gain 12.4%

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*Manufacturers of Welded Fabrications to Specification*

## LANCASTER BRANCH

The Lancaster Branch, A.E.S. met this evening at 8 o'clock at the Stevens Trade School. There were 25 members and visitors present. The secretary read the minutes of our January meeting and they were approved.

The reports on the activity of the Research Committee were read. There was no additional business so the meeting was turned over to the librarian.

Mr. H. L. Hovis, of the Hamilton Watch Co., was introduced. The subject of his talk was the "Cleaning and Plating of Small Parts." Mr. Hovis opened his talk by stating that the problems of cleaning and plating about which he was going to speak, differed greatly from most industries. The various metals handled, such as steel, brass, nickel silver, silver, bronze, copper beryllium and gold were listed. In cleaning these metals the materials to be removed such as oils, buffing compounds, heat treating scale and stains must be considered. Owing to the rigid inspection cleaning and plating processes must be rigidly controlled.

In cleaning the metals the use of chlorinated solvents, emulsion cleaners, inhibited acids, sulphonated oils, proprietory cleaners and special cleaners developed for specific use were cited. Mr. Hovis stated that at the present time experimental work is being done on bright hardening and drawing to eliminate much of the trouble.

The plating solutions used were listed as being, gold, silver, copper, nickel, cobalt nickel, black nickel and rhodium. These are controlled by regular chemical analysis to maintain the proper concentrations.

Samples of various type racks were displayed and two small barrel units used for gold plating and nickel plating of small parts were demonstrated.

Samples of various parts and dials were shown to give an idea of the various finishes and types of plating dome. After a brief discussion period the meeting was closed at 9:45 o'clock.

WILLIAM H. FORDNEY

## BALTIMORE-WASHINGTON BRANCH

The 17th and most successful Annual Educational Session and Dinner Dance of the Baltimore-Washington Branch was held at the Maryland Yacht Club on Saturday, February 3rd, 1945. About 80 people assembled in the afternoon to hear Dr. Walter Meyer, Dr. F. C. Mathers and Mr. Adolph Bregman present three interest-packed papers.

Dr. Meyer of the Enthone Co. spoke on plating on aluminum. He discussed methods for etching, smut removal and bright dipping of aluminum and its alloys in preparation for electroplating. The method of depositing an immersion coating of zinc from a solution of sodium zincate containing copper, was discussed in detail and the methods of depositing the first layer of copper from a low pH solution. After this layer is deposited any other plate can be applied. Dr. Meyer also spoke of a method of producing a black oxide on copper which utilizes sodium chloride as an oxidizing agent in a solution of caustic soda.

Dr. F. C. Mathers, Professor of Chemistry at Indiana University presented a paper on "Effects of the Composition of

Baths Upon Deposits." Dr. Mathers stated, "Less is known about water solutions than about the solutions with other liquids, because of the great complexity and unusual properties of water and its solutions. These complex combinations between the various chemicals and with water in a plating bath influence the nature of the final deposit.

"Complex cations containing acid radicals, water, addition agents, conducting salts, along with the metal itself, are deposited at the cathode. There is no other way to explain how these various substances, especially acid radicals, get to the cathode except to postulate that they were a part of the positive ions or cations. After neutralization at the cathode, the various things that were similar to ordinary crystallization or precipitation whereby the metal, with more or less of the other things, forms the final deposit. Deposits, except rarely, are not pure metals. It follows that, since the final deposit differs slightly in composition with differences in the composition of the bath, different baths will give deposits that differ in their properties." The address gave as complete proofs as possible of this theory. Examples of electrodeposits were shown.

The ladies were entertained during the Educational Session with cards. Mrs. W. P. Barrows, Mrs. K. M. Huston, Mrs. A. G. Pierdon and Mrs. L. G. Tubbs were hostesses.

One hundred fifty-nine members and guests, the largest number ever to attend a Branch dinner, enjoyed a war time special Hunt the Missing Items Banquet, which followed the educational session.

Community singing to the accompaniment of Clarence Stapleton at the piano was participated in by the happy gathering during the dinner.

After the dinner, the Banquet Chairman, Frank Davey, introduced Branch President Kenneth Huston. Ken spoke briefly on the membership growth and interest taken in the Branch during recent years. He also paid tribute to the staunch support given to the Branch by the many active charter members of the Branch. He then called upon the charter members present to acknowledge an introduction. Those responding were: Mr. William Chase, the father of the Branch; Mr. Fred F. Pierdon, the willing and able wheel horse; Dr. William Blum, the grandfather, and Wendell Barrows, Matthew Kraft, Arthur Pierdon, Tom Slattery and Armand Tschantre.

The dinner was followed by an hour's entertainment and all those present enjoyed the audience participation of Matt Kraft, Bill Bresnick and Tom Slattery. Tom had the most enjoyable part of all, especially when the mistress of ceremonies moved in from her left side to her right side so that he could see more in the front.

Dancing to Bill Robey's orchestra kept the happy gathering together until after two o'clock.

Considerable credit is given to Frank Davey, Egyptian Lacquer's representative, and his Banquet Committee consisting of Turco's Ray Stricklen, Jr. and Rheem Research Products' Harry Irvin. They are laying plans now to make the 1946 banquet even bigger and better.

RAYMOND STRICKLEN, JR., *Secretary*

## BOSTON BRANCH

Boston Branch met Thursday, February 1st at the Statler Hotel, Boston with President Swift in the chair.

Minutes of the previous meeting read and approved, communications read, one from the Convention Committee, this was turned to the Librarian, the rest were placed on file. Bills read and they were ordered paid.

The Pin Committee hope to make a final report at the April meeting.

The Banquet Committee reports that plans for the banquet are complete and hope that all the members and their friends will have the best time ever: Hotel Statler, Saturday, March 3rd. There will be no meeting March 1st because of the banquet.

Five applications were read for the first time and turned over to the Board of Managers for approval.

Five applications were approved by the Board of Managers and elected to membership.

The Membership Committee are doing a fine job in the drive for new members.

With all business out of the way, Librarian Chesworth introduced as the speaker, Ralph H. McCahan of the duPont Co., his subject was "Recent Improvements in

Cyanide Plating Solutions." He was given a rousing welcome by Boston Branch.

He had papers with him and these were passed around so that the members could follow as he went along on the following solutions: du Pont High Speed Copper, Potassium Cyanide Barrel Solutions, Copper Deplating, High Speed Silver, Gold, Cadmium (Cadalyte), Zinc Cyanide Solutions, Zinc-O-Lyte, "Durobrite," and Modified "Durobrite" Bath.

He explained the working of all these solutions as he went along and answered questions on each one, this was something new to the members and was a real treat to the visitors.

He did a very fine job and was given a rising vote of thanks for one of the finest talks heard by the Branch in a long time. Come again, Ralph.

He was answering questions after the meeting adjourned, at 11 P. M.

A. W. GARRETT, *Sec'y-Treas.*

## CHICAGO BRANCH

The Chicago Branch held its regular meeting at the Midland Hotel on Friday, February 9th.

The speaker of the evening was Mr. L. Schustik, who spoke on the "Potassium High Speed Copper Solution."

As the space for Branch news is to be limited, I suggest that all members who possibly can, come to the meetings. It is the duty of members to help in the promotion of the Branch and to assist in the education of its members.

M. H. LONGFIELD, *Secretary*

## CLEVELAND BRANCH

The monthly meeting of the American Electroplaters' Society was held on Friday evening, January 12th, 1945 at Hotel Cleveland. The speaker of the evening was Myron Diggin, Chief Chemist of Hanson Van Winkle-Munning Co., who talked on "The Bright Alloy Plating Process." His lecture described the deposition of the ternary alloy having the following composition:

| | |
|---|---|
| Copper | 56% |
| Tin | 28% |
| Zinc | 16% |

Alloy plating is very interesting to every plater because of its wide application in the field of metals. It might be pointed out that the number of metallic elements is limited while the number of alloys which can be produced is tremendous. Any color, composition to obtain metallurgical properties is unobtainable by other processes.

The plating solution for the "Bright Alloy Deposit" is composed of copper cyanide, zinc cyanide, sodium stannate, sodium cyanide, sodium hydroxide and an organic addition agent having wetting properties.

The speaker illustrated the effect of these various variables together with the recommended composition on limits very well with slides. The total metal concentration is less than one ounce per gallon. Maintaining a low total metal concentration is less than one ounce per gallon. Maintaining a low metal concentration makes the solution cheaper and less sensitive to varying operating conditions. The bath is operated with soluble alloy anodes and it is used on a voltage basis, the normal voltage being 3.5 to 4.5 volts. At this voltage, the current density is approximately 15 amp/sq. ft. and under these conditions can deposit .0002" in 23 minutes. The plating bath is operated at 145-160° F.

The bright alloy plating process offers the following properties:

1. The deposit is bright when removed from the bath and has a pleasing blue-white color.
2. The bright alloy coating has high corrosion resistance. In thickness of .0002" on brass or copper-base metals, the deposit will pass the 200-hour salt spray test. Approximately .0002" alloy deposit gives the same protection as .0005" of nickel.
3. The alloy plate is brittle with heavy deposits. It is not recommended for over .0004" thickness.
4. The deposit is harder than nickel and its wear resistance is superior to normal nickel deposits. An alloy cast anode, for example, has a hardness of 50 Rockwell C.
5. Adhesion similar to nickel. Ordinary cleaning procedure prior to plate are satisfactory.

6. The bright alloy is non-magnetic.
7. The bath has very high throwing power comparable to stannate tin.
8. Reflectivity of the deposit approaches that of silver.
9. The alloy deposit can be readily soldered.
10. The bright alloy has low contact resistance and has a conductivity of 35% of that of pure copper.
11. It is not recommended for plating on steel with an undercoat of copper.
12. Any of the common metals can be plated on the alloy.

After a period of questions and answers, the speaker was given a rising vote of thanks for his very interesting paper.

After a brief business session, the meeting was adjourned.

HARVEY P. HEIL, *Secretary*

## DAYTON BRANCH

The February meeting was held at the Engineers' Club with President Neill presiding. There were twenty-five people present.

The Research Program of the society was discussed and the Branch suggested two topics:

1) Compilation of Methods of Analysis Applicable to Plating Solutions.
2) Use of Electrolytic Methods in Analysis of Plating Solutions.

The exhibits for the coming national convention were discussed and the opinion of the branch as a whole was to limit the exhibit in no way.

Mr. Neill showed the branch the new certificates of membership. The unanimous opinion of the branch was that there should be no expiration date on the certificate due to the cost and inconvenience of having them engraved. Also, some members do not pay their yearly dues on the same date as the fiscal year and this would mean an adjustment of dues. Therefore, Mr. Neill instructed that a letter be written the Supreme Society voicing a protest against the expiration date on the membership certificates.

The Branch Research Committee appointed by Mr. Neill are: Messrs. Moline, Beaver, Collins, Teres, Hartzell. Mr. Neill outlined the duties of the Branch Research Committees as set forth by the National Research Committee.

It was decided that the final count of the postcard vote on increasing the dues and/or contributing from the branch treasury to support the research program be postponed until the next meeting.

Capt. Julius Teres was elected to fill the librarian's position vacated by the resignation of Mr. Luaces.

The speaker of the meeting, Mr. Kennedy of Du Pont, who gave a very interesting paper on "Potassium High Speed Copper Plating." The members asked many questions which brought on a short discussion of relative merits of different copper plating solutions.

The meeting was adjourned after a short discussion as to the desirability of a party in April.

H. E. AUSTEN, *Reporter*

## NEWARK BRANCH

The regular meeting of the Newark Branch, A.E.S., was held on Friday evening, February 2, 1945 at the Hotel Robert Treat in Newark, N. J. The meeting was called to order at 8:45 P.M. with President Robert R. Sizelove presiding. All other officers were present.

The minutes of the previous meeting were read and approved.

Communications from Edward W. T. Faint, W. E. Dodge, A. A. Bradd of Remington Rand, W. T. Brown and W. H. Ward of Federal Tel. & Radio requesting copies of Newark Branch's Year Book were read and placed on file.

Communications from Frank K. Savage, Gordon N. Hodge, Francis X. Thompson and Joseph Dixon Crucible Co. were read and placed on file.

A communication from the Research Committee including a supplementary list of contributors to the Research Fund, was read and placed on file.

Mr. Horace Smith presented a balance sheet on the Christmas party and the Secretary presented a balance sheet for the 1944-1945 Year Book. Both committees were given a rising vote of thanks for their efforts.

Robert Sizelove and Edward Washburn reported on the progress of the Research Committee.

Our guest speaker for the evening was a Newark Branch member, Mr. Frederick A. Lowenheim of Metal and Thermit Corporation, Rahway, N. J. His subject was "A High Speed Alkaline Tin Plating Solution."

Mr. Lowenheim exhibited numerous slides and charts of tests which were made on both Sodium Stannate and Potassium Stannate Tin Plating Solutions. From his talk and exhibits it was evident that the Potassium Stannate Bath is superior in quality to the Sodium Stannate Bath. He explained why much higher current densities could be used and why the Potassium Solution does not build up in sludge formation like the Sodium Stannate solution. He was asked numerous questions which he answered to everyone's satisfaction. Mr. Lowenheim was given a rising vote of thanks by the 52 members who attended this meeting.

Meeting was adjourned at 11 P.M.

GEORGE WAGNER, *Secretary*

## NEW HAVEN BRANCH

The regular monthly meeting of the New Haven Branch of the American Electroplaters' Society was held Tuesday, December 5, 1944 in the Sterling Chemistry Laboratory of Yale University.

The meeting opened with the showing of two Treasury Department sound films, "It Can't Last," and "The Line is Busy."

Dr. H. L. Kellner our Educational Chairman introduced Dr. William S. Murray, President of the Indium Corporation of America, Utica, New York, who spoke on "Indium Plating." Dr. Murray gave an interesting talk on the early research of Indium, its pre-war and post-war uses, and the war production role in increasing the wear and corrosion resistance of critical armament parts.

The members enjoyed a fine educational evening and gave Dr. Murray a rising vote of thanks.

Meeting adjourned at 11 P.M.

B. J. GAFFNEY, *Secretary*

## MILWAUKEE BRANCH

The Milwaukee Branch held its regular meeting Friday, February 2nd, at the Wisconsin Hotel.

Mr. Robert Steuernagel, Jr., appointed Mr. James Poulson and Mr. Arthur Hoffman as two more members of the membership's committee. He appointed Mr. T. D. Hartshorn and Mr. Omer Doyle to assist Mr. William Geissman on the funds for research committee.

After a short discussion about our banquet to be held April 28th, the meeting was turned over to librarian, Mr. William Geissman who introduced Mr. Jackson of the Udylite Company.

Mr. Jackson gave a very interesting talk on mechanical plating. He showed pictures and diagrams of ideal set-ups for barrel work.

He talked much in detail of the mechanics of barrel plating including sizes of barrels and the effect on production by having correct sizes of driers and cleaners. Some new developments in mechanical plating were of interest to everyone.

The meeting adjourned with many of the fifty members presents staying for a general discussion as is usual when a very interesting paper is presented.

JAMES DURNFORD, *Secretary*

## MONTREAL BRANCH

The meeting of the Montreal Branch, A.E.S. was held at the Mount Royal on Monday, December 4, the meeting was called to order at 8:45 by the chairman, Mr. J. T. Reisenburg. The secretary read the minutes of the November meeting. It was moved by Mr. R. Dupont and seconded by Mr. J. Roberte, that these be adopted as read.

Mr. A. S. Mitchell reported that circular letters were sent out but that the response was very slow in being returned to the committee therefore the committee could not make a report or advance any recommendations on research.

Dr. Winkle, director of research, McGill University was present as a guest and spoke for a short time on endowed scholarships. The members of Montreal branch take this opportunity of thanking Dr. Winkle for his interest and advice.

The chairman introduced the speaker for

the evening, Mr. William Gauvin, a member of Montreal branch who continued his lecture on Electrochemistry. This lecture should be of particular interest to the members because Bill has attempted to delete such material as is of no interest to the electroplater.

The meeting was adjourned at 11:20 p.m.

W. G. FINLAY, *Sec'y-Treas.*

## TWIN CITY BRANCH

The Twin City Branch met on February 5th at the Hotel Andrews, Minneapolis. President Lindemann called the meeting to order at 7:45 P.M. following our monthly dinner. There were 32 members present.

The Secretary read the minutes of the last business meeting as well as the financial report both of which were approved by the membership. Due to the absence of our membership chairman, Mr. Paul W. Felt, the Secretary introduced the new members to the branch. They were: Bernard N. Beck, Leighton R. Goodlund of Jari Products, William J. Hanson of Rapinwax, Frank W. Nelson of Perfection Mfg. Co., and Ben J. Rosenthal of Wyandotte Chemical Corp. These men were welcomed into the society and branch by the members present. Mr. George Gunderson of Perfection Mfg. Co., was the recipient of the free dinner awarded by the branch to the member whose name is drawn out of a hat and if he can name the members sitting on each side of him and across the table from him.

With the termination of our business meeting, Ralph A. Bowman, the branch's librarian, introduced Dr. R. B. Saltonstall of Udylite Corporation who presented a paper on "Bright Nickel Plating." Dr. Saltonstall answered several questions from the floor and at the conclusion of his talk, he was given a rising vote of thanks by the membership.

The meeting was adjourned at 10 p.m.

ROBERT L. BUCKLEY, *Sec'y-Treas.*

## WATERBURY BRANCH

The heaviest snowfall of the year limited the attendance at the regular meeting held Friday, February 9th at the Hotel Elton. However, there was still a goodly number to hear Myron Diggin of Hanson-Van Winkle-Munning Co. talk about "Bright Alloy Plating." Of course, Mr. Diggin is well known to the Waterbury Branch and his talks are always enjoyed. The information he gave us on the plating of these bright alloys was no exception. It was both interesting and instructive and much of practical value was gained by all present.

Our picture, too, made quite a hit, as this 53-minute technicolor film, "Combat America" followed the Flying Fortress crews of the 351st Bombardment Group from the end of their training in Colorado to actual combat over Germany. It tells the story of the crews and their gunners, showing how they live, how they fight and how they rest. It was assembled and edited by Major Clark Gable, who also serves as narrator. Admission to previous showings was only through the purchase of War Bonds, so we were exceedingly fortunate in having the opportunity of seeing it.

It was agreed by everyone present, that the meeting was well worth the effort of getting out into the snow.

S. L. HENN, *Secretary*

## PHILADELPHIA BRANCH

President Zurbach started the fourth Friday of January meeting at rather a late hour (8:30 P.M.) due to flat trouble with the secretary's car, and he had to fall back on the "Family Chariot."

Motion — dispensed with the reading of the minutes. Carried.

Letters from the Research Committee were read and turned over to Chairman Orlick of the Philadelphia Branch Committee.

Letter from Dr. Graham was read and laid over to new business.

E. F. Ottens was appointed chairman of the Exhibits' Committee.

Motion — Branch to contribute two copies of 1943-1944 Proceedings to the Library Committee. Carried.

Motion — Philadelphia Branch to contribute $1.00 out of the treasury to the Research Committee, for each dues paying member in the Branch. Carried.

Motion — the bills be paid. Carried.

President Zurbach turned the gavel over to Librarian Hirsch's assistant, Sam Heiman, who conducted a question box with George Gehling, Al Hirsch, and Gene Zurbach, Jr. as the "Answer Experts."

1. In zinc plating, which type anodes are more economical from the point of view of cyanide consumption-slab or ball anodes?
   Slab anodes probably more economical. No data available.
2. In brass plating zinc base die castings, what would cause blisters after a lapse of 3 or 4 days?
   Overcleaning of the die castings before plating.
3. Is the bond of an electrodeposit improved with heat?
   Yes, but only when diffusion or alloying takes place; such, as in the deposit of indium over lead or silver.
4. What is black chromium?
   Black chromium is deposited from regular chromium plating solutions at current densities between 1000 to 1500 a/sf below 15° C.
5. How may excess iron be removed from a cynide copper plating bath?
   No method known.
6. How may cast iron and malleable iron be zinc plated?
   May be barrel plated in a solution containing:
   5 oz./G. Zinc Cyanide
   15 oz./G. Total Cyanide
   14 oz./G. Sodium Hydroxide
   after pickling in a 14 to 16 oz./G. Sodium Cyanide plus a 2 oz./G. Sodium Hydroxide at 120° F. for ½ to 4 hours. Can be plated in an acid zinc solution.

Meeting closed with a rising vote of thanks to Sam Heiman and his "Experts."

PAUL MENTZER, SR., *Secretary*

## PITTSBURGH BRANCH

The regular meeting of the Pittsburgh Branch was held at the Roosevelt Hotel, Thursday, February 1. Dinner was served at 6:45 P.M. to eighteen members. The attendance increased to thirty-three for the meeting following the dinner.

President Johnston reported on the status of the A.E.S. Convention to be held June 18 through 21. The form requesting permission to hold the convention was filed on January 20 with the O.D.T. All requests for conventions had been turned down to date although no requests had been received from technical societies according to Mr. Shafer, representative of the Pittsburgh Convention Bureau. A long discussion by members of the branch indicated a feeling that we should not ask special privileges of the O.D.T. for the convention.

Financial aid for the National Research Committee was discussed by President Johnston and a report read on the action taken by various other branches. It was the concensus of opinion that the branch would aid the Research Committee either by an increase in dues of $1.00 per member or by an appropriation from the Branch treasury. It was decided to wait until the March meeting when we will know definitely about the Convention. Mr. Jersey, chairman of our local Research Committee read a letter from Mr. Carl Heussner on Research Problems and made a plea for the return of more suggestions for research problems.

The Pittsburgh Branch meetings are to be held the third Thursday of each month starting in March. This change in date from the first to the third Thursday of each month was made so the monthly calendar can be included in the notices and mailed several days before the meeting to Branch members.

The balance of the evening was turned over to Librarian Dick Dimon who announced a symposium on cleaning by three cleaning representatives. Mr. J. J. Duffie of Pennsylvania Salt gave a very interesting ten minute talk on the various functions of cleaners and the need for more study and consideration to cleaners. Mr. L. Camel of the Detrex Co. gave a short talk on the application of various cleaning methods for different types of soil. Mr. W. A. Rodgers of the Kolene Co. gave a short talk on the use of fused alkali for cleaning metal. Following these three talks a general discussion developed in which it was agreed that the important need for proper valuation of cleaners has not been answered. The most common evaluation of cleaners for electroplating is the adhesion and yet the adhesion is affected to a very large degree by surface conditions and treatments before and after the usual cleaning processes. As frequently happens the meeting was adjourned without an answer to the cleaning problem.

The meeting was adjourned at 10:15 p.m.

FRANK R. KELLER, *Sec'y-Treas.*

## BRIDGEPORT BRANCH

The monthly meeting of the Bridgeport Branch was held Friday, Feb. 2, 1945 at Hotel Barnum.

The roll call of officers was read and the Board of Managers R. J. O'Connors, Wm. Thompson and B. F. Kusterer were reported absent.

The Projector Committee announced that the projector is available to any member. F. B. Gotthardt, Librarian and Chairman of the Technical Sessions Committee, announced a question box session headed by two experts who are to give us the correct answers to all questions asked. Fred also announced that Dr. Walter R. Meyer would give a talk on Friday, Feb. 16, 1945 on "Treatments and Finishes for Aluminum." The printed forms containing the list of the speakers scheduled for the balance of the fiscal year were sent out to the members including the New Haven, Waterbury and Hartford Branches.

A letter from C. E. Heussner, chairman A.E.S. Research Committee, regarding our Branch's activities on the Research Program was ordered to be brought up under the heading of New Business.

A letter from E. T. Candee, Executive Secretary and Editor, containing a list of contributors to the Rsearch Fund and urging participation in sending a list of projects to the Research Committee in which our Branch is interested was ordered to be brought up in conjunction with Huessner's letter under the heading of New Business.

A letter from the Boston Branch inviting us to attend their tenth annual Technical session and Banquet to be held on March 3, 1945. All members planning to attend should make their reservations early by writing to Mr. Louis Gagnon, 31 Ames St., Cambridge, Mass.

A letter from F. R. Keller, Secretary-Treasurer of the Pittsburgh Branch regarding Branch papers for the coming convention was turned over to President A. R. McNeil.

A letter from Spencer L. Henn, Secretary-Treasurer of the Waterbury Branch regarding the New England Regional Meeting. President A. R. McNeil will report on this under the heading of New Business.

President A. R. McNeil opened the discussion on the Research Committee business at hand. C. C. Helmle gave us a talk on the work the Research Committee does and after opinions by Ray Kwasnik, Fred Gotthardt, V. DeNaples, Seymour Wattenberg, A. R. McNeil, Larry Griffin, Hubert Goldman, James McGrath and Wm. Ehrencrona, a motion was made and passed to support the Research Committee and a Branch Committee to be appointed. President McNeil appointed the following:

Chairman, Clarence C. Helmle; Seymour Wattenberg, Raymond Kwasnik.

President A. R. McNeil and L. F. Griffin attended the New England Regional Meeting at Waterbury, January 20 and report the Bridgeport Branch has the task of advertising. The next meeting will be held Feb. 10, 1945 at Waterbury. The results to be reported at our next business meeting.

President McNeil turned the meeting over to Librarian F. B. Gotthardt, who made arrangements for a question box session. Fred appointed C. C. Helmle and Ray Kwasnik as the Board of Experts to answer all the questions that were offered by the members and guests present. Needless to mention the Experts have done a good job for which the members thanked them and after a discussion, the meeting was adjourned.

Meeting adjourned at 11:00 PM.

JOSEPH G. STERLING, *Sec'y--Treas.*


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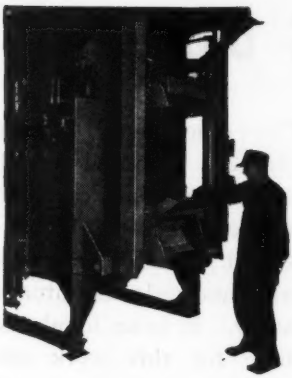

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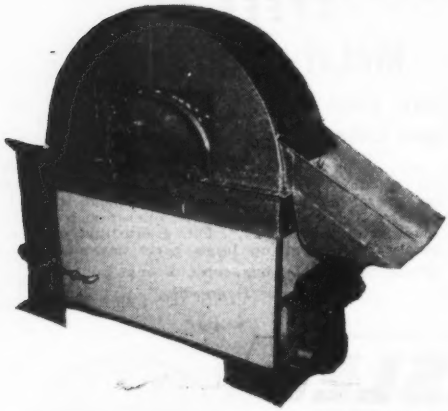

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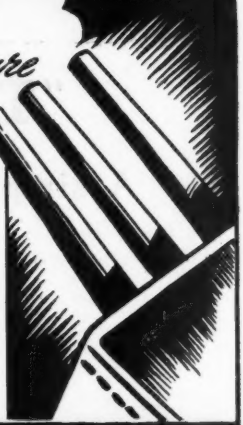

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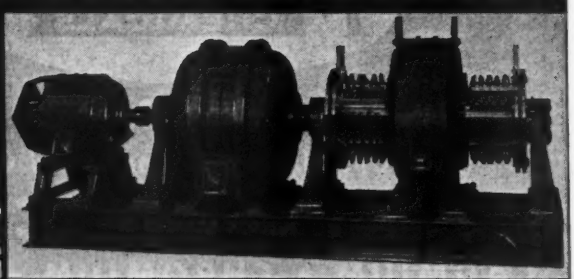

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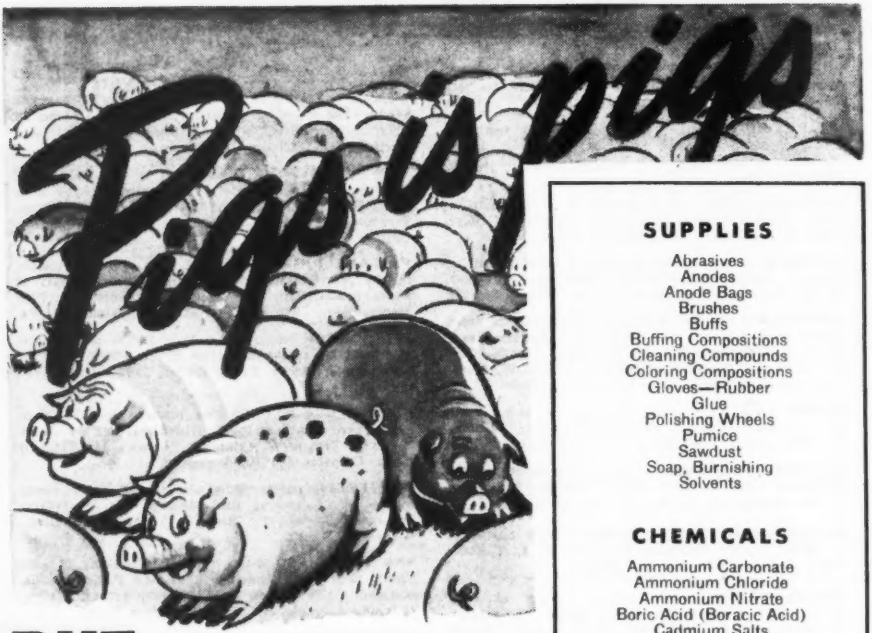


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A one-bath process that gives a deep, rich black to iron and all steels except stainless by oxidation at 300° F. BLACK-MAGIC processes for zinc, copper, brass and cadmium are approved for small arms, ammunition, aircraft and signal corps applications.

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Cleaning, Finishing, and Plating

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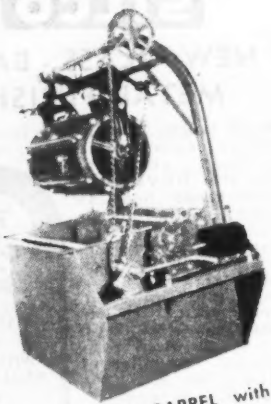
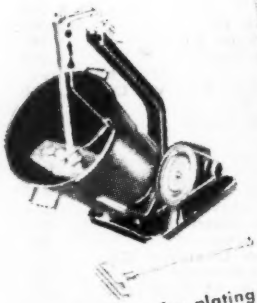
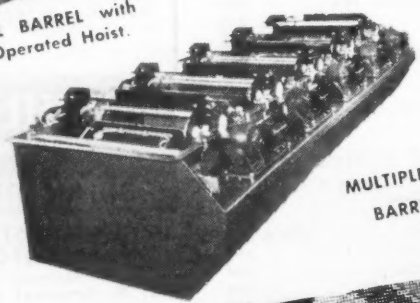
Our New England Sales Engineer will be pleased to help you determine the metal cleaning, finishing, and plating equipment best suited to your needs. Consult him about your cleaning or finishing problems. Ask him to describe the many new types of equipment that are now available. Place your orders in advance to assure deliveries.



HORIZONTAL BARREL with Manually Operated Hoist.



HANDIPLATER— for plating odd lots of small parts



MULTIPLE PLATING BARREL UNIT

# USE THESE Improved COMPOUNDS for Soak or Electro-Cleaning

**METEX C** Fast acting, low price alkali, recommended for soak cleaning prior to barrel plating where economy is prime importance. Effectively cleans at reduced temperatures with reduced concentrations and has little heavy soap flotations. Cleans brass or steel.

**METEX 11W** Heavy duty steel cleaner developed for economical soak cleaning prior to barrel cleaning. Is easy to use, has no heavy soap flotations and cleans at low temperatures with reduced concentrations.

**METALEX** The original MAC DERMID compound perfected for cleaning non-ferrous metals in vertical tumbling barrels and as a soak or electro-cleaner. Available in special variations for specific cleaning operations.

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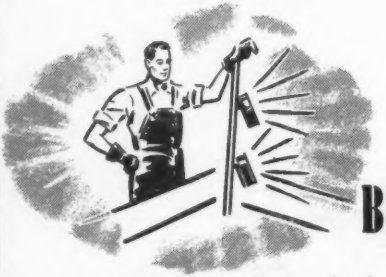
# *New* H-VW-M Bright Alloy Plating Process

**(COPPER • TIN • ZINC Alloy)**

**OFFERS *UNIQUE COMBINATION* OF PROPERTIES**

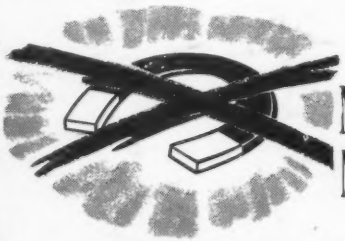


## BRIGHT

... as taken from plating bath. Silvery white deposits. High tarnish resistance.

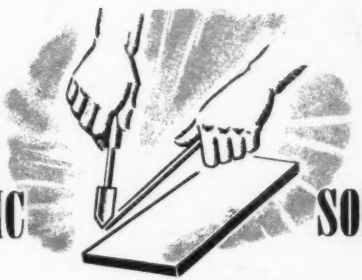
## HARD

... has good abrasion resistance.



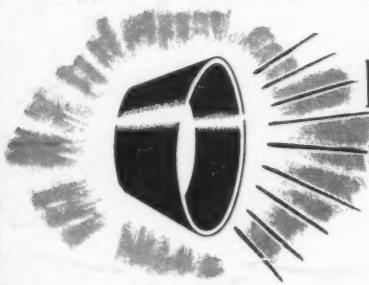
## NON-MAGNETIC

... relatively high electrical conductivity, low contact resistance.



## SOLDER

... easily with non-corrosive flux.



## LOW INTERNAL STRESS

permits forming of plated articles.

### ... and Handles EASILY!

Common chemicals used, low solution cost. Good deposit distribution. Simple thickness determination. Lighter deposits required. Superior throwing power. Can be barrel, still, or basket plated. Control by analytical methods.

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